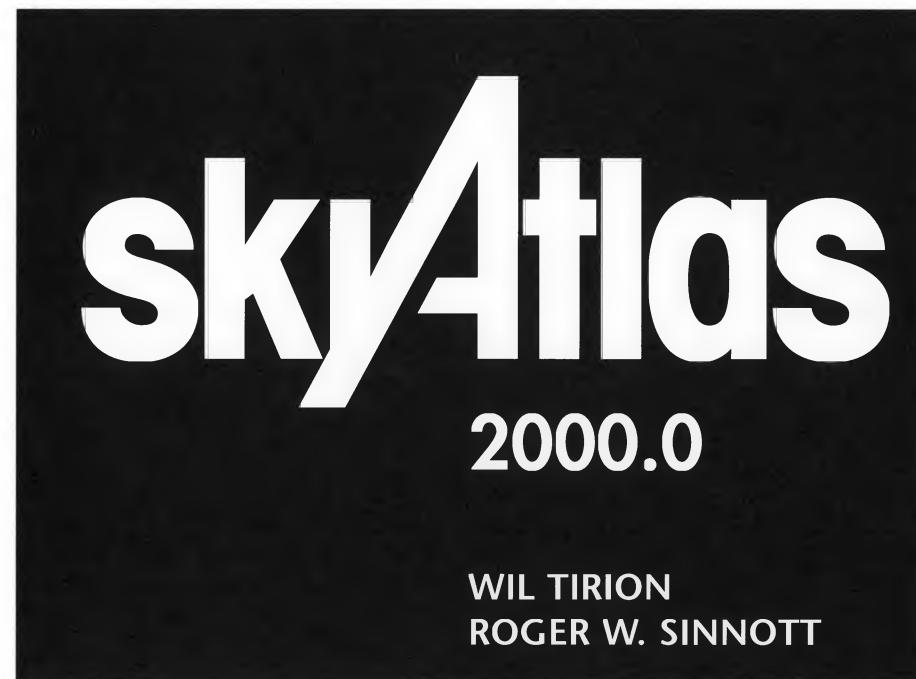


SECOND EDITION

*Twenty-six star charts,  
covering both hemispheres, and  
seven detailed charts of selected regions*



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# INTRODUCTION

WHEN IT ARRIVED on the scene in 1981, the original *Sky Atlas 2000.0* by Wil Tirion was the first comprehensive set of star charts tailored for the coordinate equinox now in universal use. Carefully planned and executed with the active observer in mind, the atlas contained some 43,000 stars to visual magnitude 8.0 and about 2,500 deep-sky objects.

Without departing from that work's philosophy and chart arrangement, this second edition brings with it many significant enhancements. By going to magnitude 8.5 instead of 8.0 we have nearly doubled the number of plotted stars, ensuring that star patterns will be easier to recognize at the telescope or in binoculars. The number of deep-sky objects is increased as well, but more modestly, to about 2,700. We have also made a more homogeneous selection, thanks to the advent of better machine-readable databases and the closer attention paid by astronomers in recent years to the sky's southern hemisphere. Apart from the infusion of new material, long-time *Sky Atlas* users will notice that some of the dimmest nonstellar objects plotted in the first edition are now omitted because they did not “make the cut,” as described below, using the more recent data.

Like its predecessor, this second edition comes in three formats. The full-size, wirebound, Deluxe Version — with a generous scale of 8.2 millimeters per degree — uses color coding to help distinguish deep-sky objects and the Milky Way from ordinary stars. The Desk and Field versions are printed in black and white with a scale of 7.1 mm per degree. The Desk Version has black stars on a white sky, and the Field Version has white stars on a black sky; both are unbound sets of charts. The Desk and Field versions are also available wirebound with charts laminated in clear plastic for protection against moisture and dirt.

The **stars** for this new edition are its most sweeping enhancement. They are taken from the *Hipparcos* and *Tycho Catalogues*, the fruit of nearly four years of all-sky scans by the European Space Agency's Hipparcos satellite. When published in 1997, that monumental compilation supplanted overnight all previous surveys as a reliable census of the positions and brightnesses of the one million brightest stars. This atlas contains all stars measured by Hipparcos to have a visual magnitude of 8.5 or brighter. For double stars, the same cutoff applies to the combined magnitude of the pair. Variable stars missed by Hipparcos, but which can also rise above 8.5, have been added from the *General Catalogue of Variable Stars* (Kholopov et al., 1985). All told, the number of stars shown as single, double, or variable in this atlas is 81,312.

Moreover, computer graphics has allowed us to plot a continuous progression of dot sizes for star brightnesses, whereas the earlier edition binned the stars in whole-magnitude steps. For this reason, and because the magnitude values used for plotting are those measured in the *V* band of the modern *UBV* photometric system, the ranking of stars by brightness should correspond even more closely to what the human eye sees. Keep in mind that photographic emulsions and electronic detectors often respond somewhat differently than the human eye to stars of var-

ious colors; on photographs and digital images, therefore, star patterns can differ noticeably from those found in the atlas.

**Double and multiple stars** are indicated by a short line protruding from opposite sides of the star symbol. If the components are separated by more than 200 arcseconds on the sky, they are plotted separately. Where they are combined — as indicated by the short line — the total or “merged” magnitude is used for the size of the dot. Usually the short line is horizontal; sometimes it is oriented another way to avoid hitting an adjacent star or grid line.

No attempt has been made to mark every known double star, nor to distinguish line-of-sight (“optical”) pairs from true binary systems. Instead, the double-star symbol identifies those most likely to interest observers with small telescopes under good conditions. Pairs with a separation between 0.5 and 30 arcseconds are included if the companion is about magnitude 10.5 or brighter. Details of their telescopic appearance may be found in *Sky Catalogue 2000.0, Volume 2* (Hirshfeld and Sinnott, 1985). Wider pairs, out to 200 arcseconds, are shown by the same merged symbol and bar, but only if both components are magnitude 8.5 or brighter.

**Variable stars** of magnitude 8.5 or brighter are indicated by a concentric circle-and-dot symbol approximating the star's range. An open circle alone means the star's minimum is fainter than the atlas's 8.5 cutoff. Locations of historical novae and supernovae that have briefly risen to 6.0 or brighter are marked with an × and identified by the letter N or SN and the year of outburst.

Again, no attempt has been made to mark every known variable star, but only those that fluctuate by a half magnitude or greater. The light curves of such stars can be compiled by a careful observer using a telescope visually, while stars that vary with a smaller amplitude call for electronic detectors and special procedures. For this reason, fewer stars are marked as variables in this edition of the atlas than in the earlier one.

The portrayal of **deep-sky objects** — star clusters, nebulae, and galaxies — is summarized in the legend at the top of each chart. Each symbol can take on a variety of sizes related to apparent size on the sky. Of course, only the largest objects could be plotted to scale. In a major improvement over the first edition, the ellipses representing galaxies are oriented the same way they appear on the sky, regardless of size.

On the whole we have retained compact objects to a fainter total magnitude than larger, more diffuse ones. Such a selection rule is roughly in keeping with the ease with which they may be spotted in small telescopes. For example, the atlas includes open clusters if the combined light of member stars is magnitude 8.5 or brighter. Globular clusters, typically more condensed, are plotted to magnitude 11. Galaxies are shown to a cutoff of about magnitude 13 (in blue light) and planetary nebulae to 14 (in blue light).

For the most part, outlines of bright and dark nebulae are adapted from those in the more detailed *Millennium Star Atlas* (Sinnott and Perryman, 1997) and *Uranometria 2000.0* (Tirion et

al., 1987). To prepare them we checked celestial photographs taken in both red and blue light, notably those in the *Atlas of Galactic Nebulae* (Neckel and Vehrenberg, 1985–90). Bright nebulae are plotted with solid outlines and dark nebulae with dashed ones. In the Deluxe Version of the atlas, the symbols of bright nebulae are filled with green; the interiors of dark nebulae are left white, by analogy with the atlas's use of white chart paper to represent the dark sky. Many of the dark nebulae, labeled with B and a serial number, were originally catalogued by American astronomer E. E. Barnard (1927).

In the Deluxe Version, the **Milky Way** is portrayed with four shades of blue that represent approximate brightness levels found by Dutch astronomer Antonie Pannekoek (1920, 1929). The deepest blues are the brightest features of our galaxy, best appreciated under country skies far away from city lights. The galactic poles and equator are those adopted by the International Astronomical Union (IAU) in 1958. For clarity at reduced scale, the contours of the Milky Way are omitted from the black-and-white Desk and Field charts, but the Milky Way's general path is evident from the line representing the galactic equator and wherever the sky has a greater concentration of faint stars.

| LOWERCASE GREEK ALPHABET USED IN STAR DESIGNATIONS |          |           |           |
|----------------------------------------------------|----------|-----------|-----------|
| α alpha                                            | η eta    | ν nu      | τ tau     |
| β beta                                             | θ theta  | ξ xi      | υ upsilon |
| γ gamma                                            | ι iota   | ο omicron | φ phi     |
| δ delta                                            | κ kappa  | π pi      | χ chi     |
| ε epsilon                                          | λ lambda | ρ rho     | ψ psi     |
| ζ zeta                                             | μ mu     | σ sigma   | ω omega   |

**Constellation boundaries**, shown by finely dotted lines, are those assigned by Belgian astronomer Eugène Delporte in his 1930 work, *Délimitation Scientifique des Constellations*, and soon thereafter adopted by the IAU. Because these line segments are defined along arcs of right ascension and declination for equinox 1875.0 and then precessed to 2000.0, they show a “skewing” effect that is quite noticeable near the poles and elsewhere when they fall close to a coordinate line.

Throughout the atlas, labeling has been planned for maximum clarity and minimum confusion and ambiguity. Constellation names, in uppercase letters, are usually placed near constellation boundaries where they are easy to find. Common names, such as Castor, Polaris, Algol, and Mira, are included for nearly 200 individual stars. Many of the bright ones in a given constellation also have a Greek-letter designation given by Johann Bayer in 1603, a number introduced by John Flamsteed a century later, or an occasional Roman letter or superscript assigned by some other astronomer. In general, a bright star is labeled first with its Flamsteed number, then the Bayer letter if the star has one. Either is understood to be followed by the genitive (possessive) form of the constellation name. For example, the star in Ursa Major commonly called Dubhe and labeled “50 α” on chart 2 is referred to both as 50 Ursae Majoris and α Ursae Majoris.

Inevitably, when Delporte selected the modern constellation boundaries, they sometimes excluded outlying stars (usually

fainter ones) that traditionally belonged to a given constellation. For example, near the center of chart 6, the stars labeled 14 and 15 LMi (the abbreviation for Leonis Minoris) are seen to lie within the modern boundaries of Ursa Major. Similarly, 10 UMa (the abbreviation for Ursae Majoris) is in Lynx. Such expatriates are rapidly falling out of use; this edition of the atlas retains fewer anachronistic names than the first one did.

In most cases, deep-sky objects are labeled with their NGC (*New General Catalogue*) or IC (*Index Catalogue*) number. The first is given without a letter prefix on the charts, while the second has the letter I and a small dot in front of the number. If an object is also in the Messier catalogue, it is so labeled as well. The Andromeda Galaxy, for example, is marked “224 M31” on chart 4 because it is known both as NGC 224 and Messier 31. An object lacking one or more of these designations is indicated by some other special one. The letter prefixes used in this atlas, along with their meanings, are given in the table below.

A number of objects are also labeled with popular names, such as the Double Cluster in Perseus (chart 1) and the Trifid Nebula in Sagittarius (chart 22).

Following the 26 main charts are two more, A and B, showing

| ABBREVIATIONS USED WITH NONSTELLAR OBJECTS |               |                                                              |
|--------------------------------------------|---------------|--------------------------------------------------------------|
| Prefix                                     | Type          | Astronomer, Work, or Observatory                             |
| (none)                                     | various       | <i>New General Catalogue</i> (NGC)                           |
| B                                          | dark nebula   | E. E. Barnard (1857–1922)                                    |
| Bas                                        | open cluster  | Basel                                                        |
| C                                          | galaxy        | <i>Catalogue of Galaxies and Clusters of Galaxies</i> (CGCG) |
| Cr                                         | open cluster  | P. Collinder                                                 |
| E                                          | galaxy        | European Southern Observatory (ESO)                          |
| F                                          | galaxy        | A. P. Fairall                                                |
| H                                          | open cluster  | Harvard College Observatory                                  |
| Ho                                         | open cluster  | A. R. Hogg                                                   |
| I.                                         | various       | <i>Index Catalogue</i> (IC)                                  |
| K                                          | open cluster  | Ivan King                                                    |
| Ly                                         | open cluster  | Gösta Lyngå                                                  |
| M-                                         | galaxy        | <i>Morphological Catalogue of Galaxies</i> (MCG)             |
| M                                          | various       | Charles Messier (1730–1817)                                  |
| Pi                                         | open cluster  | P. Pismis                                                    |
| R                                          | bright nebula | A. W. Rodgers, C. T. Campbell, and J. B. Whiteoak (RCW)      |
| Sh2-                                       | bright nebula | Stewart Sharpless                                            |
| St                                         | open cluster  | J. Stock                                                     |
| Tom                                        | open cluster  | Clyde W. Tombaugh (1906–1997)                                |
| Tr                                         | open cluster  | Robert J. Trumpler (1886–1956)                               |
| U                                          | galaxy        | <i>Uppsala General Catalogue</i> (UGC)                       |
| vdB                                        | bright nebula | Sidney van den Bergh                                         |
| Wa                                         | open cluster  | Waterloo                                                     |

close-ups of special-interest regions. The scale here is 2.5× larger, and the stellar magnitude limit is 10.5, for easier star-hopping at the telescope. **Chart A** shows the two polar regions and the paths traced by the celestial poles during the 10 centuries from A.D. 1500 to 2500. (The poles' paths are gently curved because each is part of a full circle traced out by the precession of the Earth's axis in about 26,000 years.) Also included are close-ups of the Pleiades

and the fields of two famous nearby stars that happen to be fainter than the main atlas’s cutoff. Barnard’s Star, of magnitude 9.5, is traveling northward through Ophiuchus at nearly 0.3° per century — the largest proper motion of any known star. Eleventh-magnitude Proxima Centauri, which at 4.22 light-years is the nearest star to our Sun, moves 0.1° per century. **Chart B** features the part of Virgo known as the “realm of the galaxies” and the nebula-rich region of Orion’s Belt and Sword.

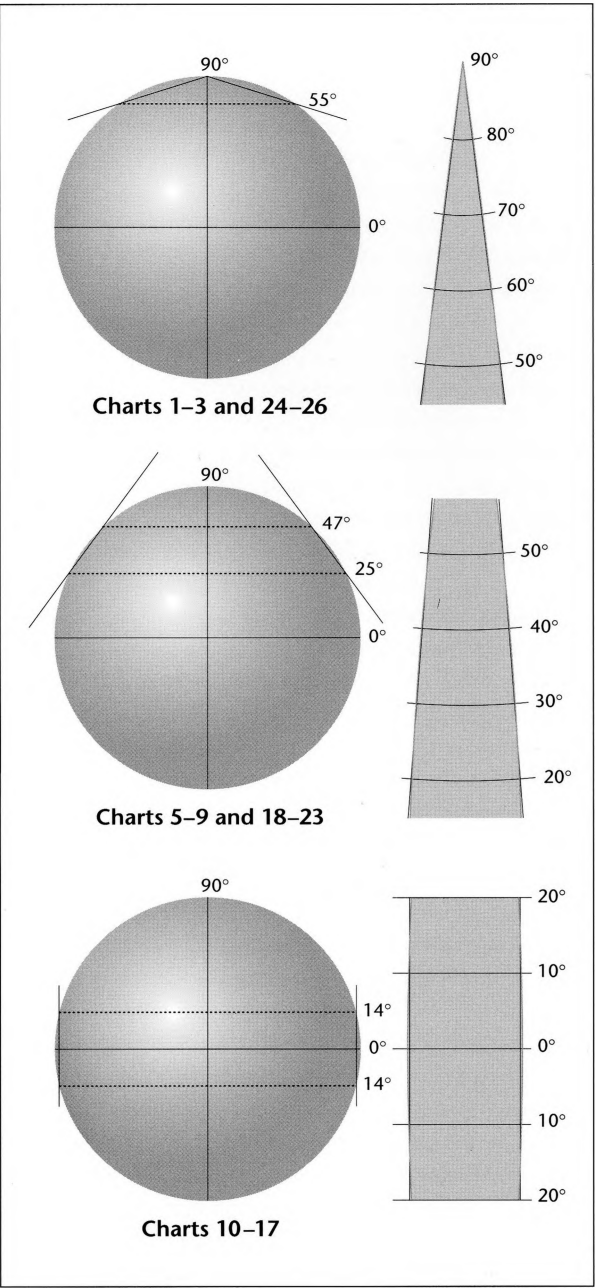
To help users navigate through the atlas, the left and right margins of the 26 main charts contain small arrows to adjoining areas of the sky and the numbers of the charts on which these regions may be found.

In planning both the original and new editions of *Sky Atlas 2000.0*, particular attention has been paid to constructing its charts not only with great accuracy, but also on map projections that minimize the distortion of constellation figures and asterisms. These important properties are far from universal among other star atlases, as George Lovi explained in his introduction to the first edition. The diagram at the right shows the geometrical principles behind the secant conic (top two) and secant cylindrical (bottom) projections used in this atlas. They are so named because the projection surface cuts through the sphere. The cartographic term for the circle of intersection is “standard parallel”; here they are actually declination circles shown by horizontal dotted lines. Along these parallels the distortion is zero, because the hour-circle spacing with respect to the declination curves is the same as on the sky. To the immediate right of each figure is a one-hour right-ascension segment showing the approximate declination range of each chart group as well as the amount of distortion. The black vertical (or nearly vertical) lines, which are straight, are the hour circles in the atlas, while the shaded ones weaving in and out represent the same coordinate lines on the celestial sphere. The correspondence of the two is a very good indication of how closely this atlas matches the sky. And the fact that the shaded lines depart from the black ones by virtually equal amounts to either side shows how well the projections split what differences there are.

Accompanying the atlas is a transparent overlay on which are shown grids for measuring the coordinates of objects, adding new ones, or plotting the track of a newly discovered comet. Also included, at the atlas’s scale, is the bull’s-eye pattern found in the popular Telrad finders widely used on commercial and homemade telescopes.

On the overlay, each grid is labeled along its sides by the declination value in degrees and the right ascension value in minutes of time for alignment with the corresponding section of a chart. Along with the right-ascension scale is a second, reversed scale preceded by the letter R; it provides a handy way to read the right ascension of a plotted star or other object with much greater accuracy. When the overlay is positioned correctly on the declination lines, and the left line of the grid (the one marked with the letter R) is positioned on the center of the object, one can then count backward to the nearest hour circle and estimate the minutes value to a fraction of a minute.

We are indebted to Richard Tresch Fienberg and Simon Mitton, who handled the publishing arrangements, and to Sally



M. MacGillivray, who coordinated the production effort for this second edition of *Sky Atlas 2000.0*. We especially appreciate our collaboration with Michael A. C. Perryman, project scientist of the Hipparcos mission, who made the Hipparcos data available to us well in advance of its public release. Thanks also to E. Talmadge Mentall and Alan M. MacRobert, who scrutinized and annotated proofs of all the charts before we went to press, and to Steven Simpson for his advice on graphics, Susan B. Bryant for proofreading, and Lynn Sternbergh for her elegant design of the front matter and cover. Their involvement has helped to ensure that this atlas will remain useful and relevant to the astronomical community for many years to come.

Wil Tirion and Roger W. Sinnott  
August 1998

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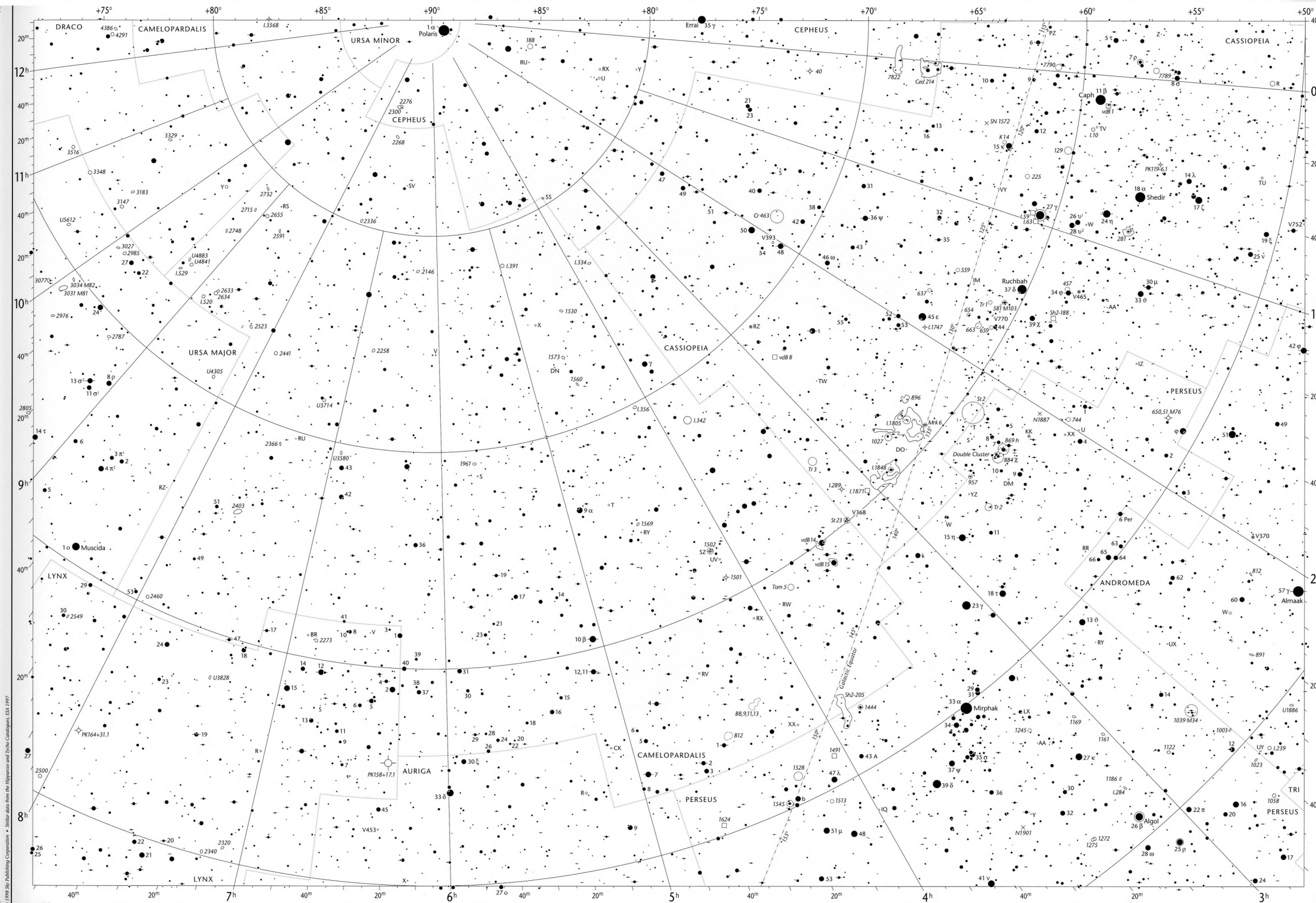
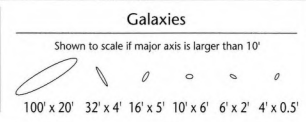
Each main chart spans roughly the following portion of the sky, at a scale of 8.2 millimeters per degree (Deluxe Version) or 7.1 mm per degree (Desk and Field):

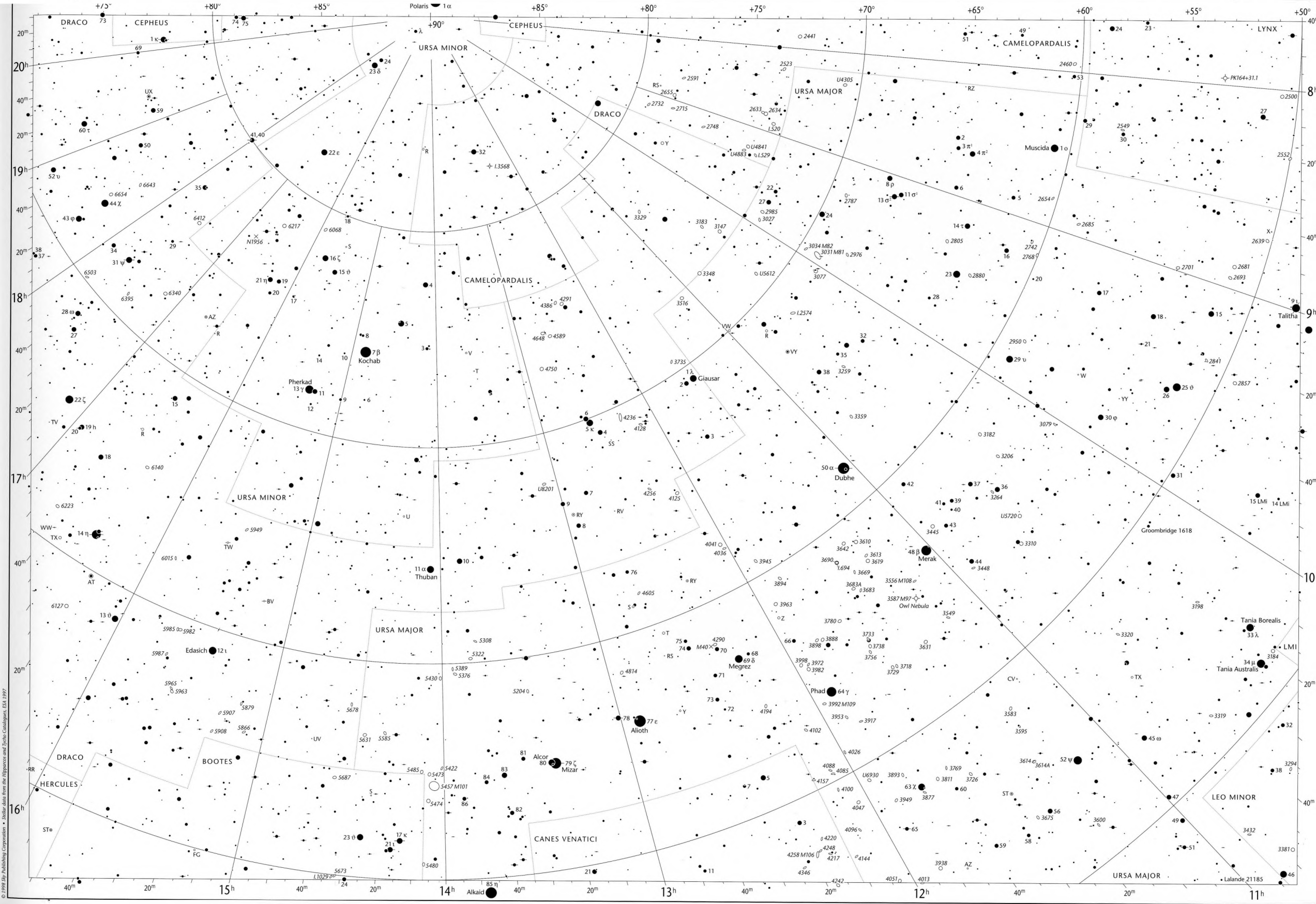
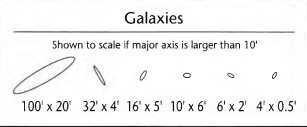
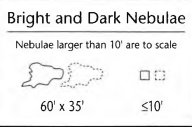
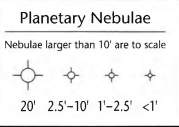
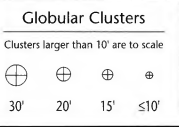
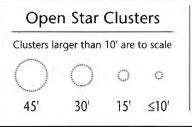
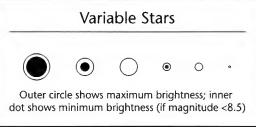
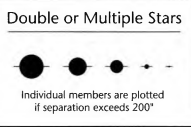
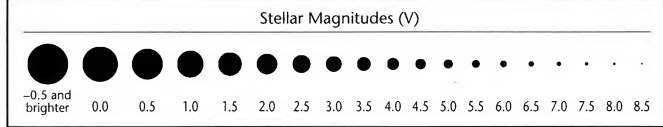
| Chart | Right Ascension                    | Declination  | Chart | Right Ascension                    | Declination  |
|-------|------------------------------------|--------------|-------|------------------------------------|--------------|
| 1     | 0 <sup>h</sup> to 8 <sup>h</sup>   | +50° to +90° | 14    | 12 <sup>h</sup> to 16 <sup>h</sup> | +20° to −20° |
| 2     | 8 <sup>h</sup> to 16 <sup>h</sup>  | +50° to +90° | 15    | 15 <sup>h</sup> to 19 <sup>h</sup> | +20° to −20° |
| 3     | 16 <sup>h</sup> to 24 <sup>h</sup> | +50° to +90° | 16    | 18 <sup>h</sup> to 22 <sup>h</sup> | +20° to −20° |
| 4     | 0 <sup>h</sup> to 4 <sup>h</sup>   | +20° to +50° | 17    | 21 <sup>h</sup> to 1 <sup>h</sup>  | +20° to −20° |
| 5     | 4 <sup>h</sup> to 8 <sup>h</sup>   | +20° to +50° | 18    | 0 <sup>h</sup> to 4 <sup>h</sup>   | −20° to −50° |
| 6     | 8 <sup>h</sup> to 12 <sup>h</sup>  | +20° to +50° | 19    | 4 <sup>h</sup> to 8 <sup>h</sup>   | −20° to −50° |
| 7     | 12 <sup>h</sup> to 16 <sup>h</sup> | +20° to +50° | 20    | 8 <sup>h</sup> to 12 <sup>h</sup>  | −20° to −50° |
| 8     | 16 <sup>h</sup> to 20 <sup>h</sup> | +20° to +50° | 21    | 12 <sup>h</sup> to 16 <sup>h</sup> | −20° to −50° |
| 9     | 20 <sup>h</sup> to 24 <sup>h</sup> | +20° to +50° | 22    | 16 <sup>h</sup> to 20 <sup>h</sup> | −20° to −50° |
| 10    | 0 <sup>h</sup> to 4 <sup>h</sup>   | +20° to −20° | 23    | 20 <sup>h</sup> to 24 <sup>h</sup> | −20° to −50° |
| 11    | 3 <sup>h</sup> to 7 <sup>h</sup>   | +20° to −20° | 24    | 0 <sup>h</sup> to 8 <sup>h</sup>   | −50° to −90° |
| 12    | 6 <sup>h</sup> to 10 <sup>h</sup>  | +20° to −20° | 25    | 8 <sup>h</sup> to 16 <sup>h</sup>  | −50° to −90° |
| 13    | 9 <sup>h</sup> to 13 <sup>h</sup>  | +20° to −20° | 26    | 16 <sup>h</sup> to 24 <sup>h</sup> | −50° to −90° |

Each close-up chart has a scale of 20.5 millimeters per degree (Deluxe Version) or 17.8 mm per degree (Desk and Field):

| Chart | Right Ascension                                                    | Declination  |
|-------|--------------------------------------------------------------------|--------------|
| A1    | 17 <sup>h</sup> 42 <sup>m</sup> to 18 <sup>h</sup> 10 <sup>m</sup> | +1° to +7°   |
| A2    | 3 <sup>h</sup> 32 <sup>m</sup> to 4 <sup>h</sup> 03 <sup>m</sup>   | +22° to +26° |
| A3    | 13 <sup>h</sup> 55 <sup>m</sup> to 14 <sup>h</sup> 50 <sup>m</sup> | −59° to −64° |
| A4    | 0 <sup>h</sup> 00 <sup>m</sup> to 24 <sup>h</sup> 00 <sup>m</sup>  | +85° to +90° |
| A5    | 0 <sup>h</sup> 00 <sup>m</sup> to 24 <sup>h</sup> 00 <sup>m</sup>  | −85° to −90° |
| B1    | 12 <sup>h</sup> 03 <sup>m</sup> to 12 <sup>h</sup> 58 <sup>m</sup> | +3° to +20°  |
| B2    | 5 <sup>h</sup> 25 <sup>m</sup> to 5 <sup>h</sup> 57 <sup>m</sup>   | +5° to −10°  |







Stellar Magnitudes (V)

-0.5 and brighter 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

Double or Multiple Stars

Individual members are plotted if separation exceeds 200"

Variable Stars

Outer circle shows maximum brightness; inner dot shows minimum brightness (if magnitude < 8.5)

Open Star Clusters

Clusters larger than 10' are to scale  
45' 30' 15' ≤10'

Globular Clusters

Clusters larger than 10' are to scale  
30' 20' 15' ≤10'

Planetary Nebulae

Nebulae larger than 10' are to scale  
20' 2.5'-10' 1'-2.5' <1'

Bright and Dark Nebulae

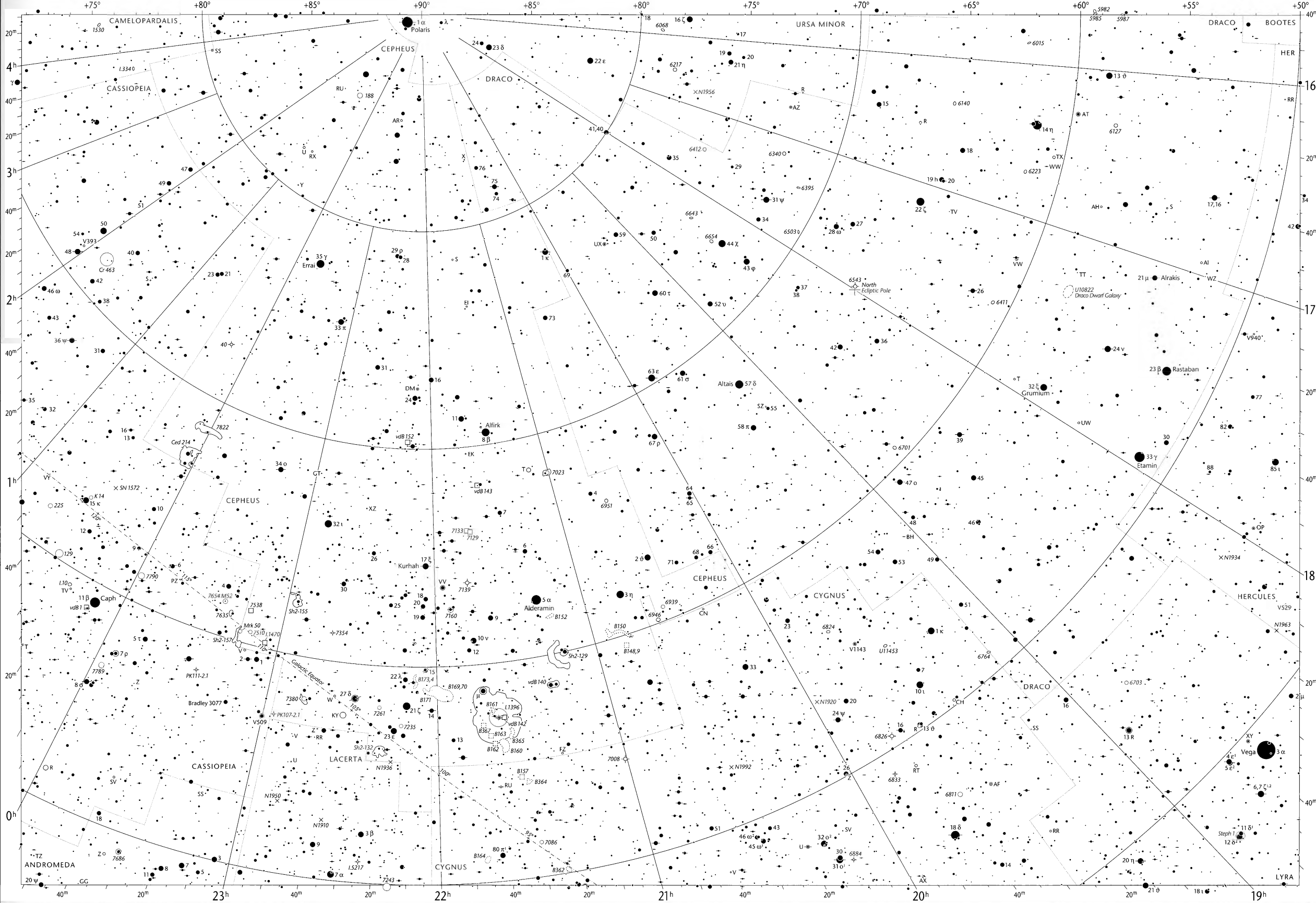
Nebulae larger than 10' are to scale  
60' x 35' ≤10'

Galaxies

Shown to scale if major axis is larger than 10'  
100' x 20' 32' x 4' 16' x 5' 10' x 6' 6' x 2' 4' x 0.5'

CHART NUMBER

3





Stellar Magnitudes (V)

Double or Multiple Stars

Variable Stars

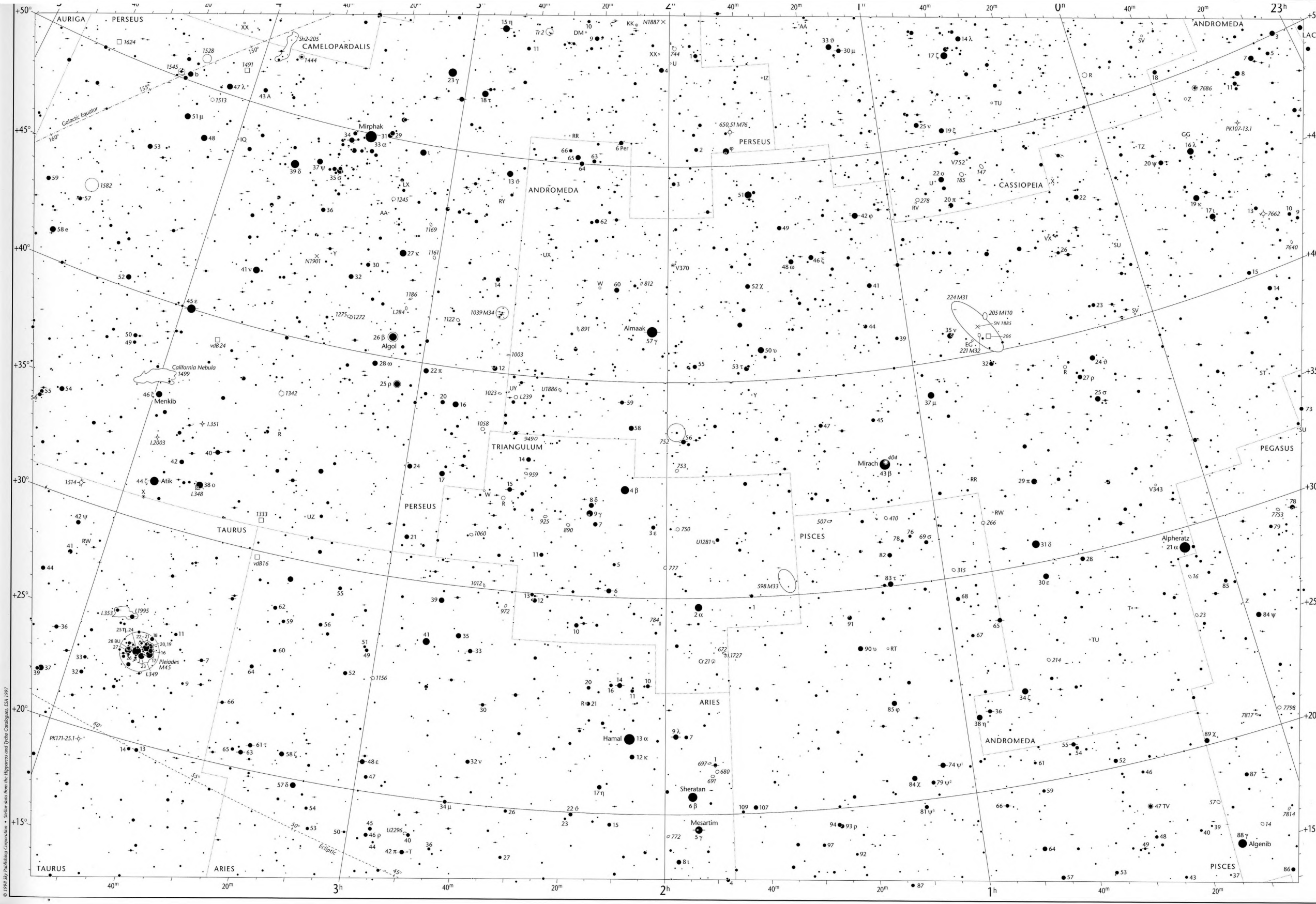
Open Star Clusters

Globular Clusters

Planetary Nebulae

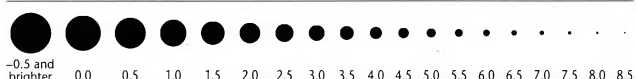
Bright and Dark Nebulae

Galaxies

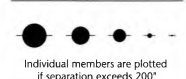




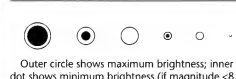
Stellar Magnitudes (V)



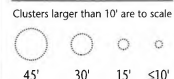
Double or Multiple Stars



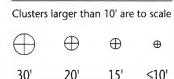
Variable Stars



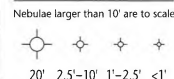
Open Star Clusters



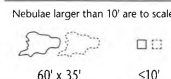
Globular Clusters



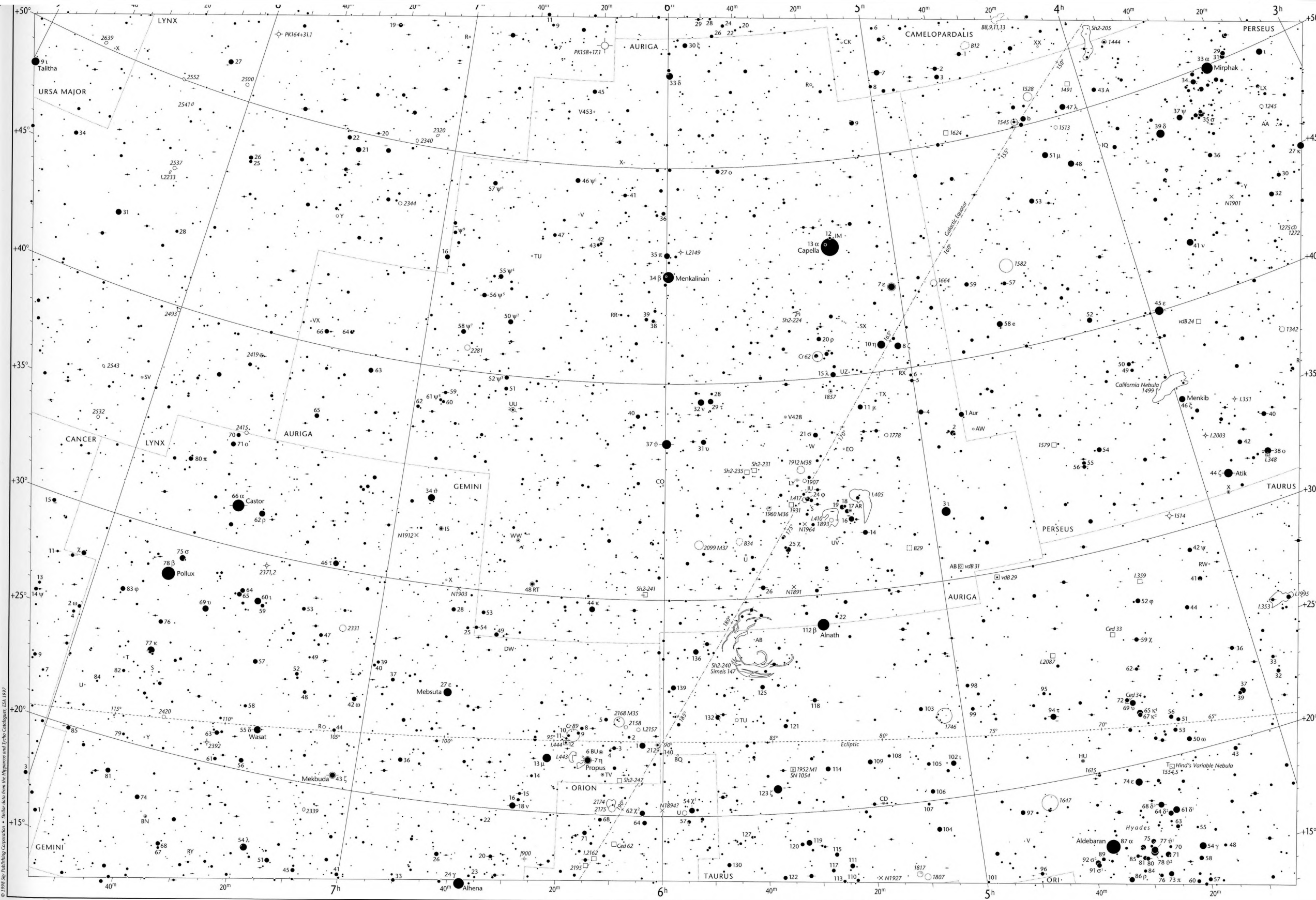
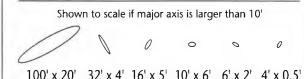
Planetary Nebulae



Bright and Dark Nebulae



Galaxies



Stellar Magnitudes (V)

Double or Multiple Stars

Variable Stars

Open Star Clusters

Clusters larger than 10' are to scale

Globular Clusters

Clusters larger than 10' are to scale

Planetary Nebulae

Nebulae larger than 10' are to scale

Bright and Dark Nebulae

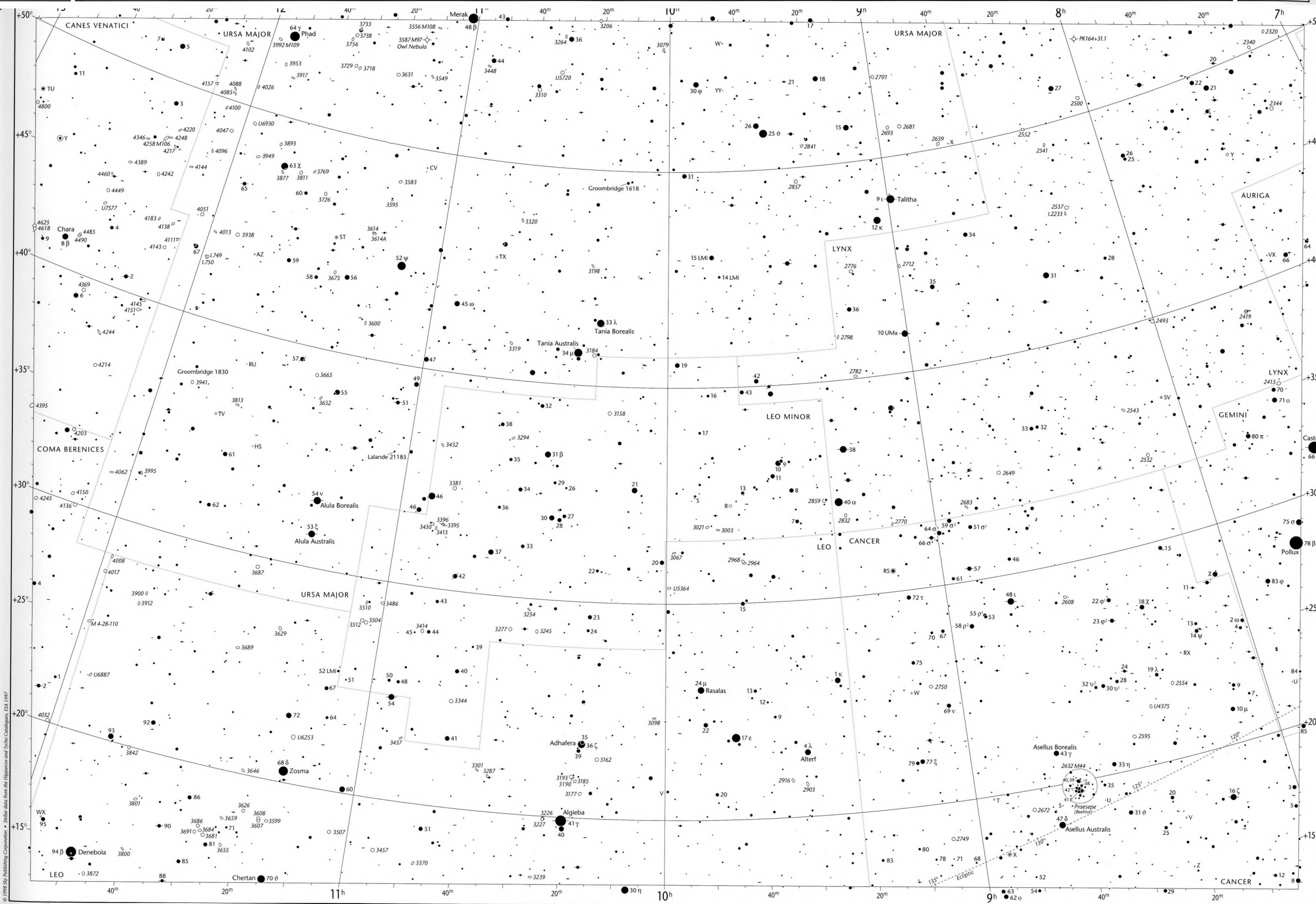
Nebulae larger than 10' are to scale

Galaxies

Shown to scale if major axis is larger than 10'

CHART NUMBER

6



Stellar Magnitudes (V)

-0.5 and brighter 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

Double or Multiple Stars

Individual members are plotted if separation exceeds 200"

Variable Stars

Outer circle shows maximum brightness; inner dot shows minimum brightness (if magnitude < 8.5)

Open Star Clusters

Clusters larger than 10' are to scale  
45' 30' 15' <10'

Globular Clusters

Clusters larger than 10' are to scale  
30' 20' 15' <10'

Planetary Nebulae

Nebulae larger than 10' are to scale  
20' 2.5'-10' 1'-2.5' <1'

Bright and Dark Nebulae

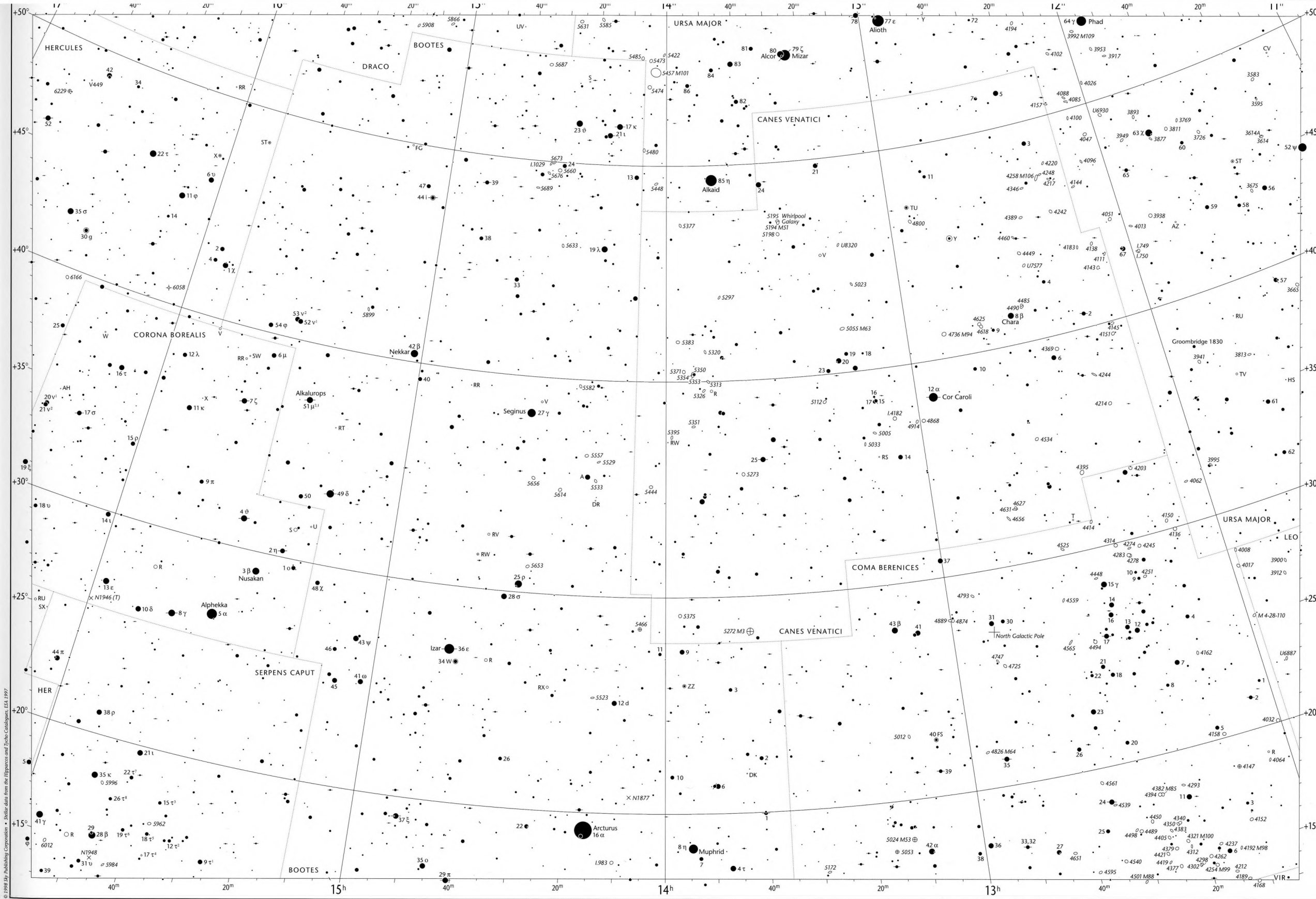
Nebulae larger than 10' are to scale  
60' x 35' <10'

Galaxies

Shown to scale if major axis is larger than 10'  
100' x 20' 32' x 4' 16' x 5' 10' x 6' 6' x 2' 4' x 0.5'

CHART NUMBER

7





Stellar Magnitudes (V)

-0.5 and brighter 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

Double or Multiple Stars

Individual members are plotted if separation exceeds 200"

Variable Stars

Outer circle shows maximum brightness; inner dot shows minimum brightness (if magnitude < 8.5)

Open Star Clusters

Clusters larger than 10' are to scale

45' 30' 15' ≤10'

Globular Clusters

Clusters larger than 10' are to scale

30' 20' 15' ≤10'

Planetary Nebulae

Nebulae larger than 10' are to scale

20' 2.5'-10' 1'-2.5' <1'

Bright and Dark Nebulae

Nebulae larger than 10' are to scale

60' x 35' ≤10'

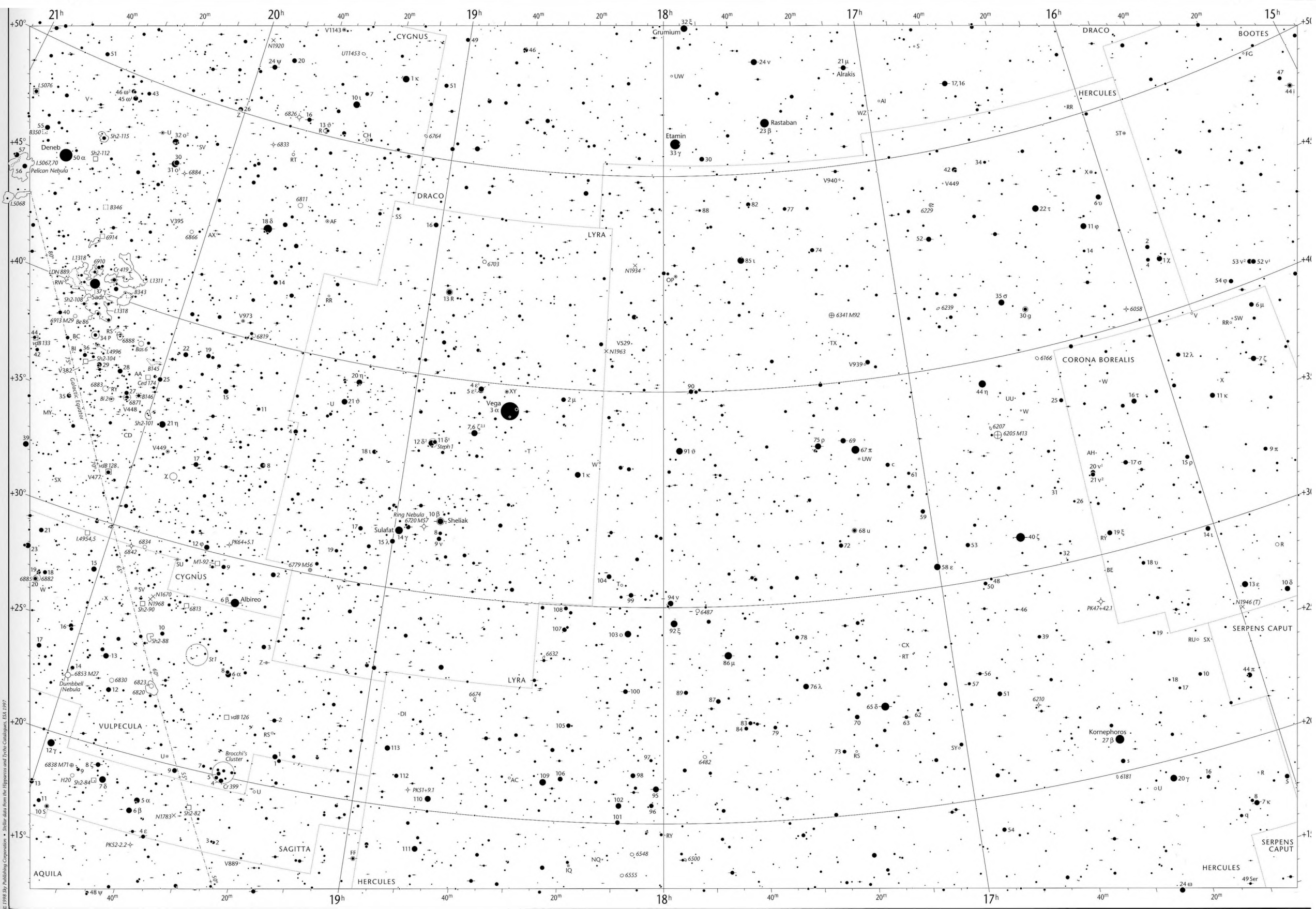
Galaxies

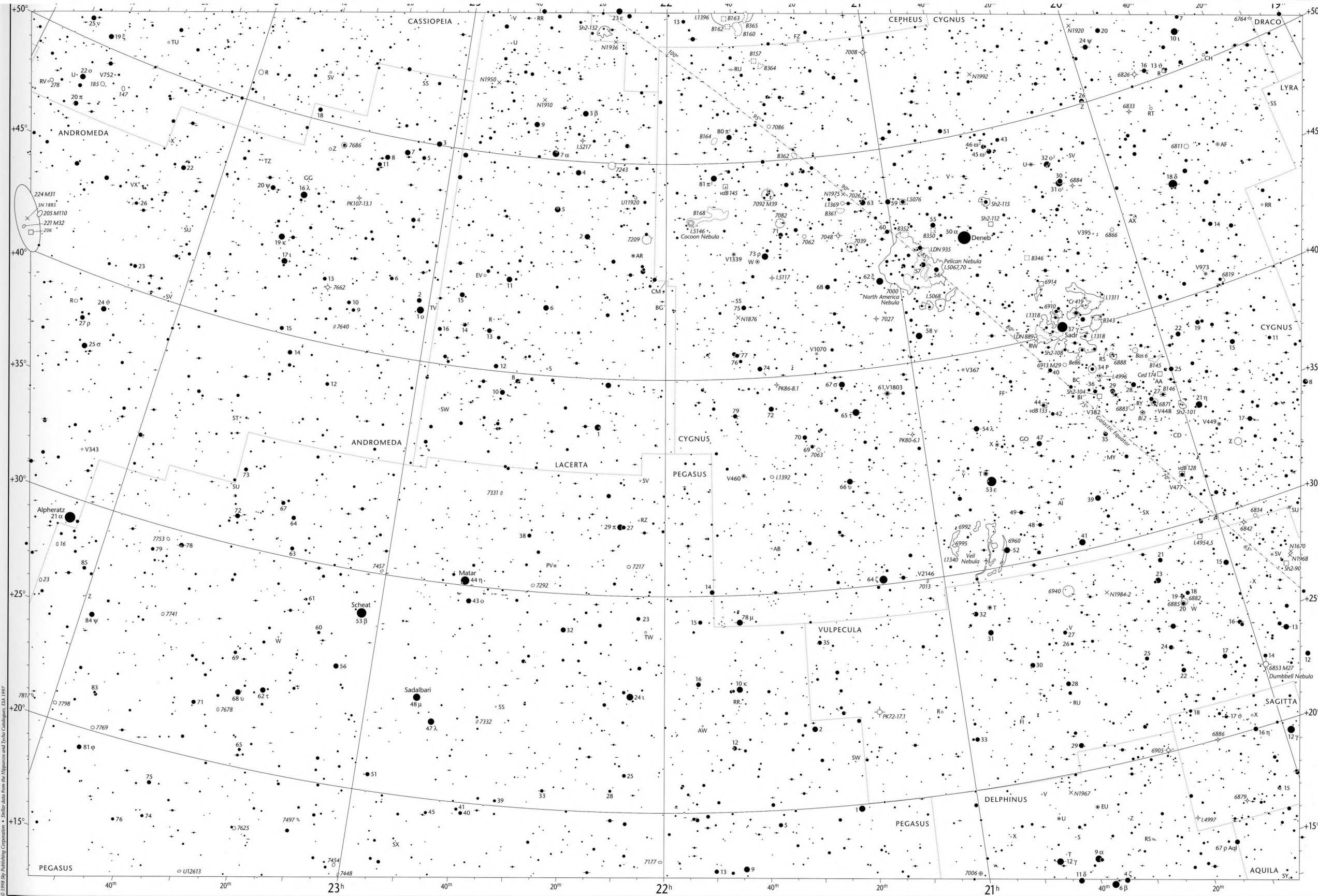
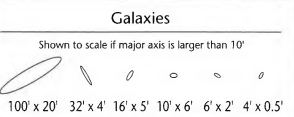
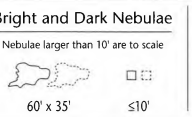
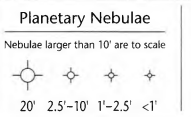
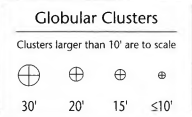
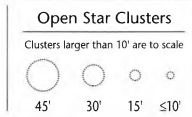
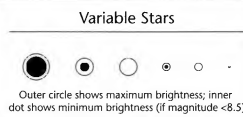
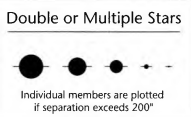
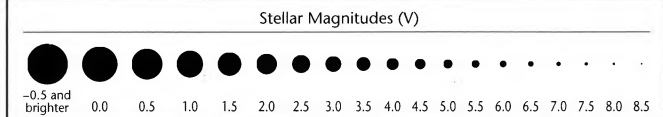
Shown to scale if major axis is larger than 10'

100' x 20' 32' x 4' 16' x 5' 10' x 6' 6' x 2' 4' x 0.5'

CHART NUMBER

8





Stellar Magnitudes (V)

-0.5 and brighter 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5

Double or Multiple Stars

Individual members are plotted if separation exceeds 200"

Variable Stars

Outer circle shows maximum brightness; inner dot shows minimum brightness (if magnitude <8.5)

Open Star Clusters

Clusters larger than 10' are to scale  
45' 30' 15' ≤10'

Globular Clusters

Clusters larger than 10' are to scale  
30' 20' 15' ≤10'

Planetary Nebulae

Nebulae larger than 10' are to scale  
20' 2.5'-10' 1'-2.5' <1'

Bright and Dark Nebulae

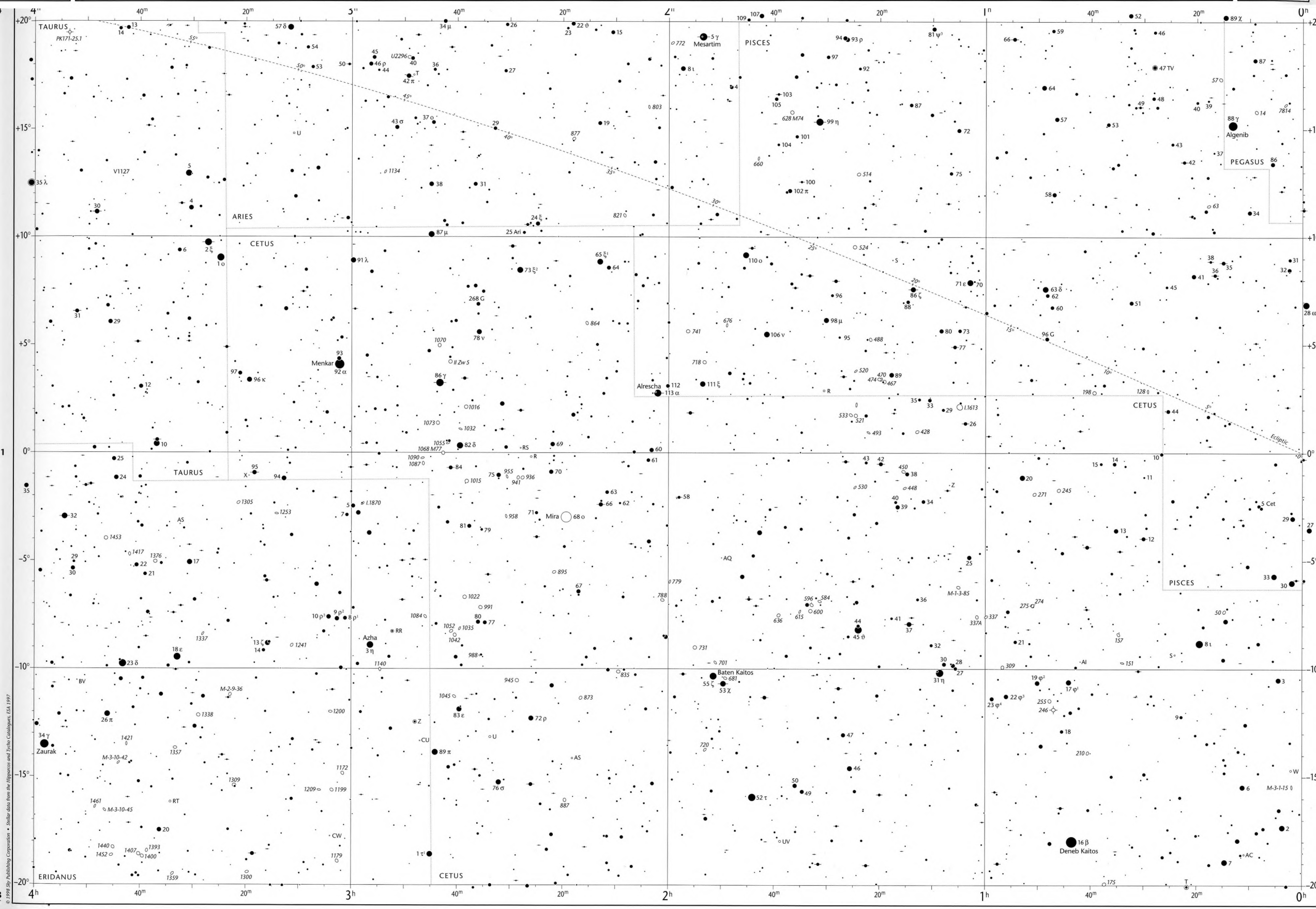
Nebulae larger than 10' are to scale  
60' x 35' ≤10'

Galaxies

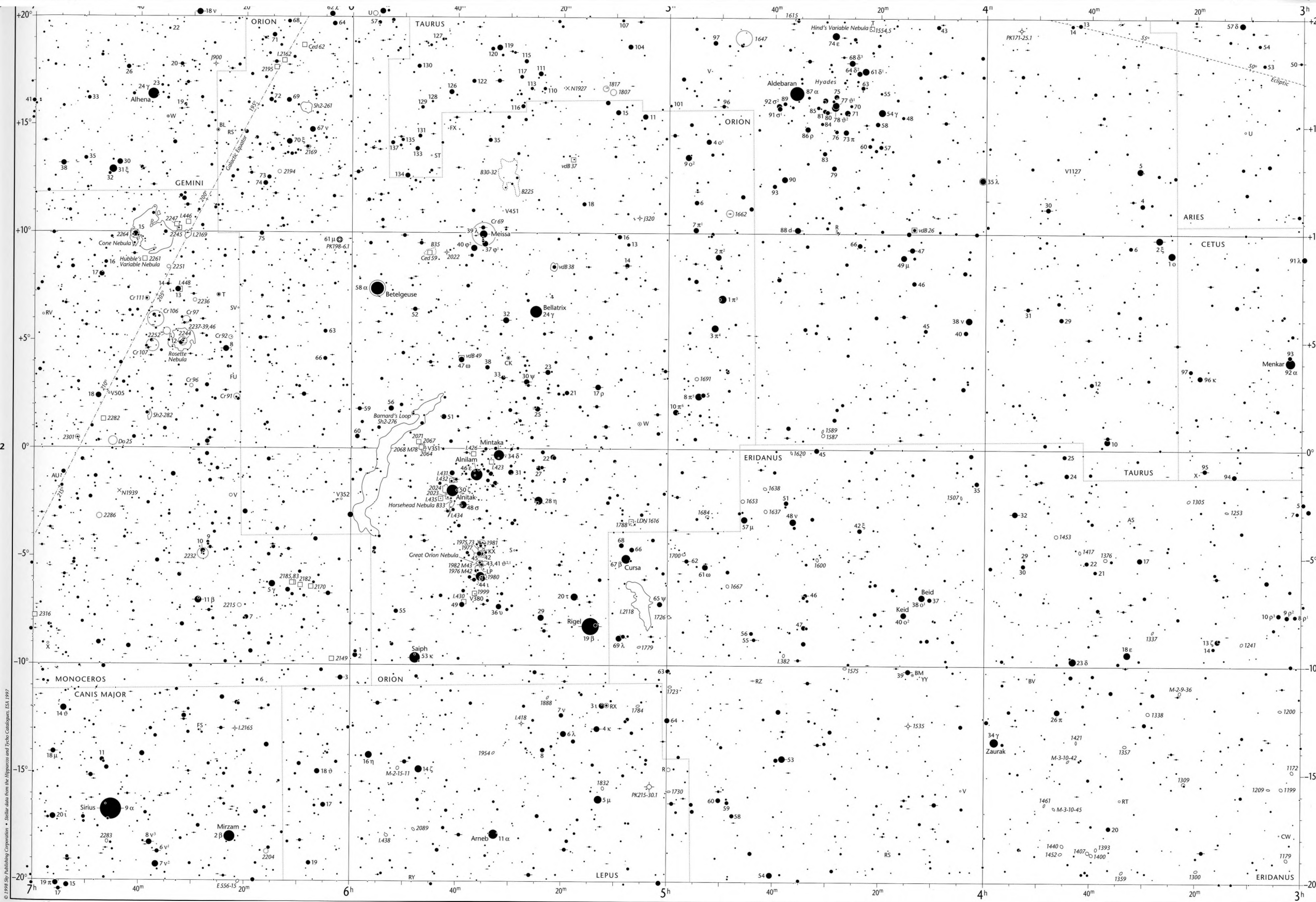
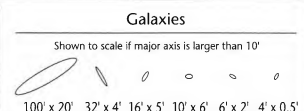
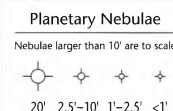
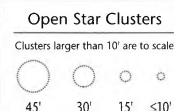
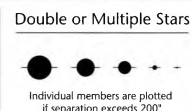
Shown to scale if major axis is larger than 10'  
100' x 20' 32' x 4' 16' x 5' 10' x 6' 6' x 2' 4' x 0.5'

CHART NUMBER

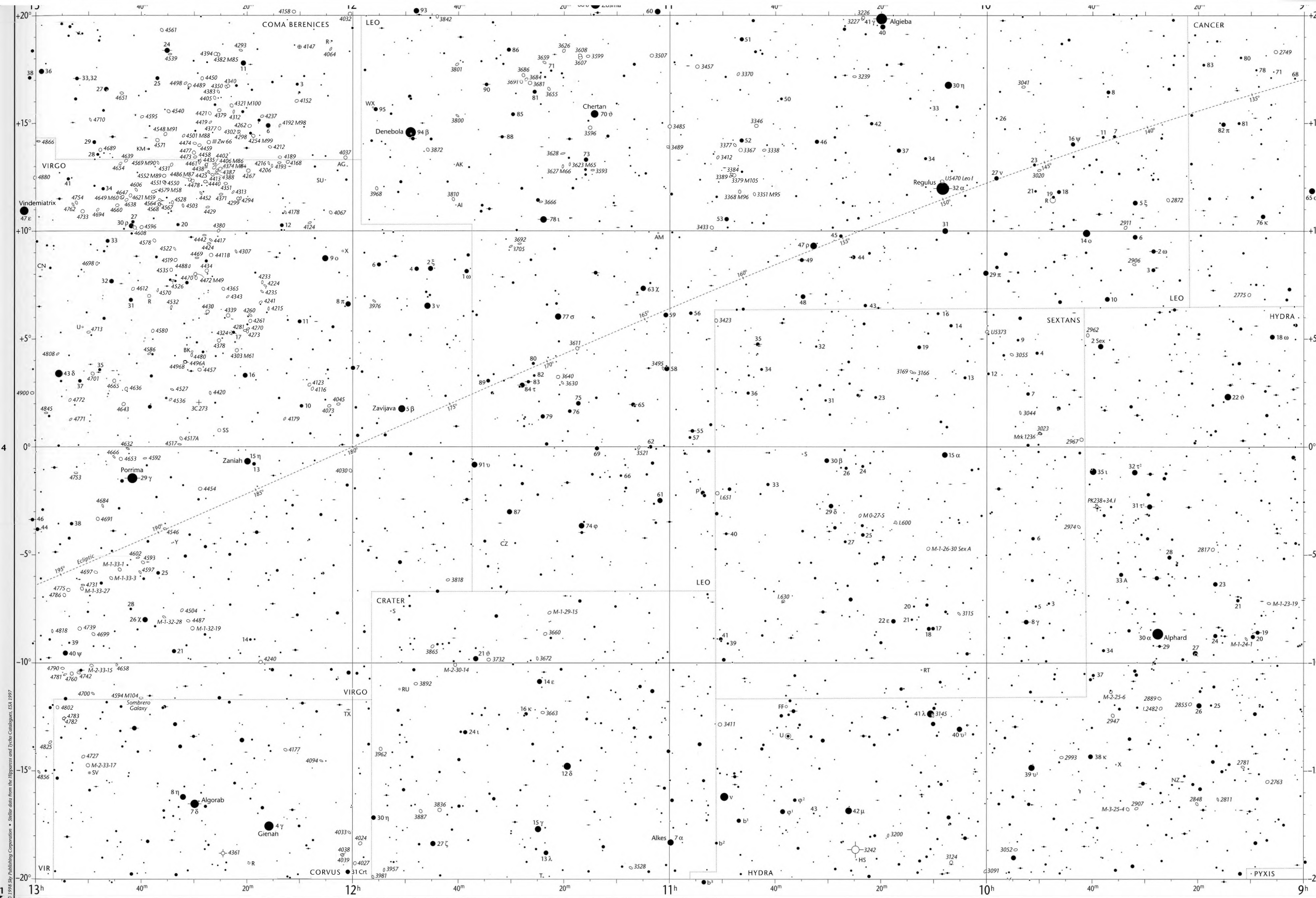
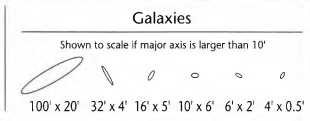
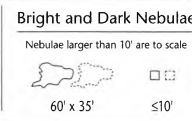
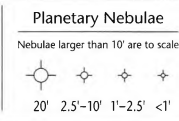
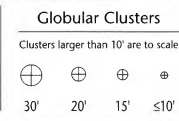
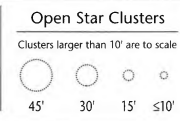
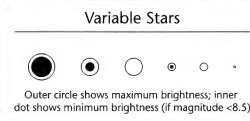
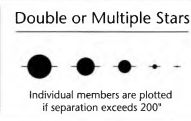
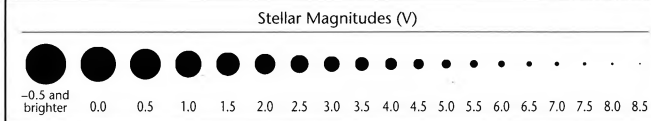
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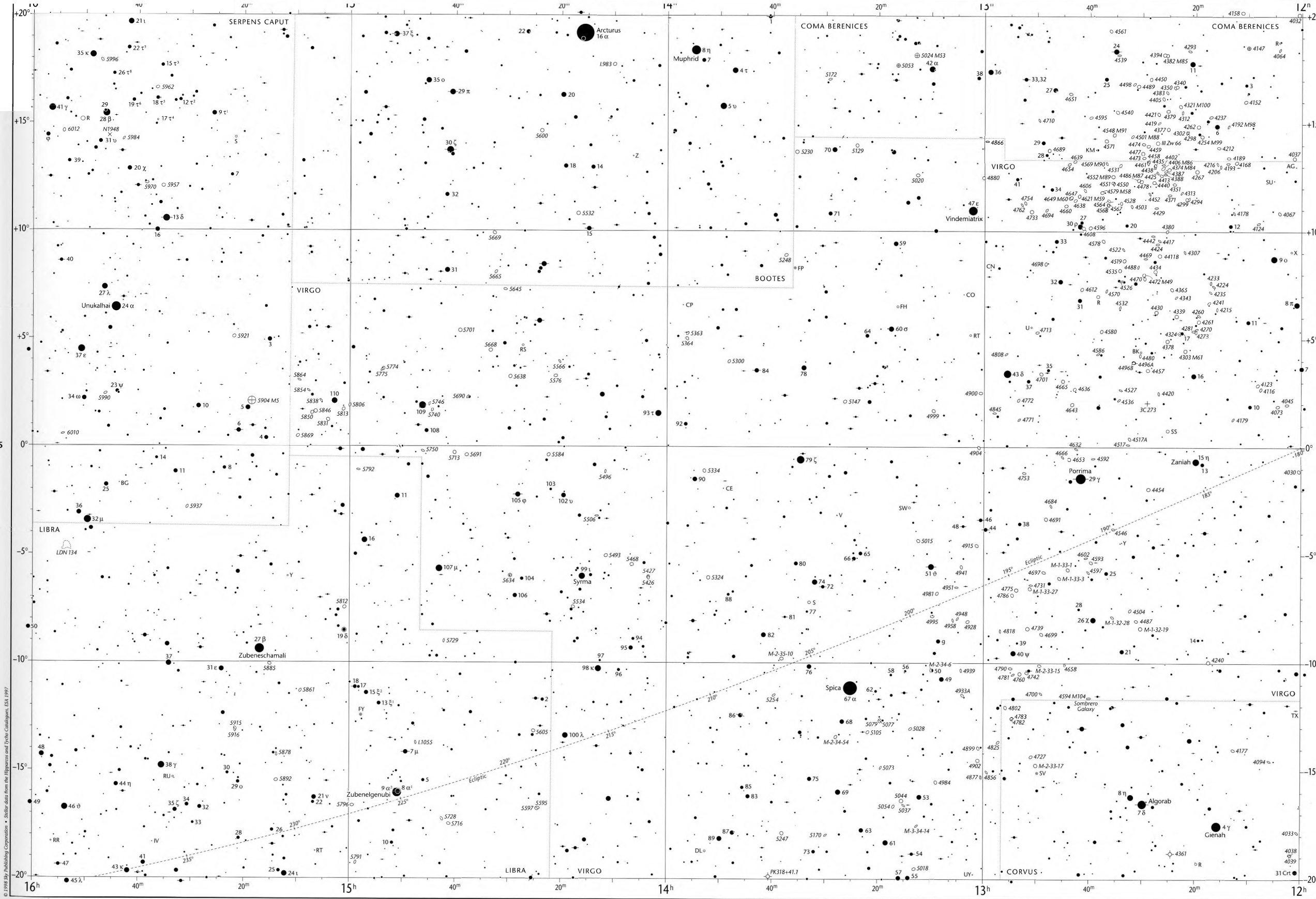
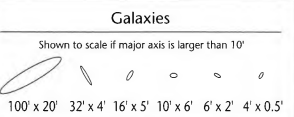
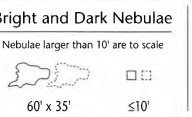
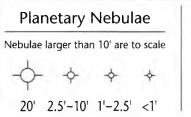
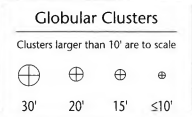
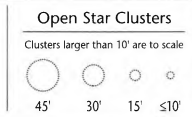
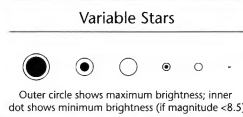
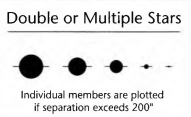
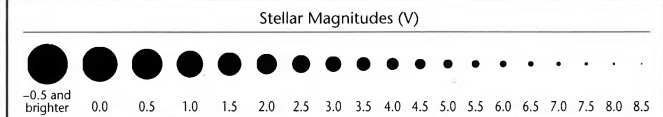












Stellar Magnitudes (V)

Double or Multiple Stars

Variable Stars

Open Star Clusters

Clusters larger than 10' are to scale

Globular Clusters

Clusters larger than 10' are to scale

Planetary Nebulae

Nebulae larger than 10' are to scale

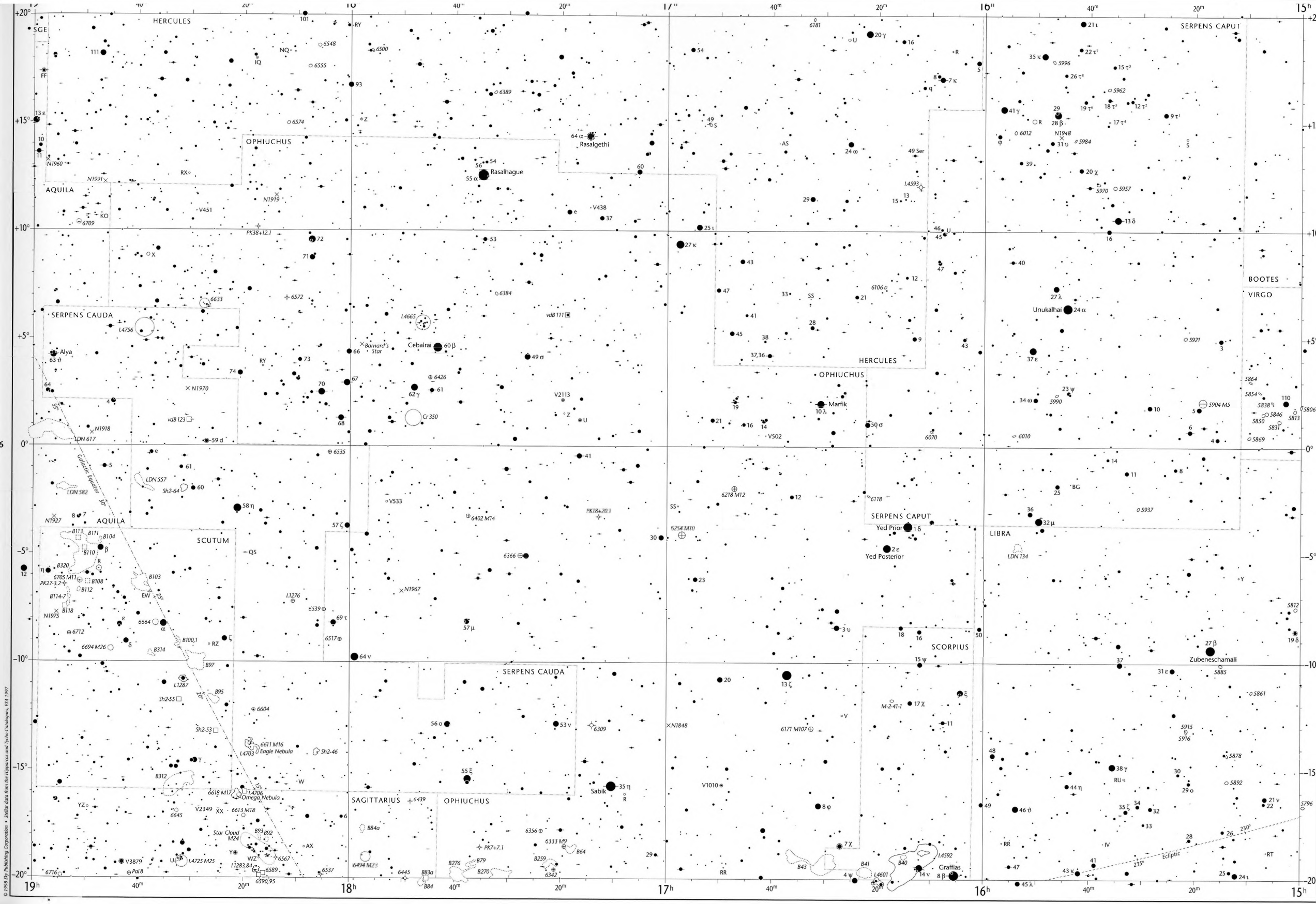
Bright and Dark Nebulae

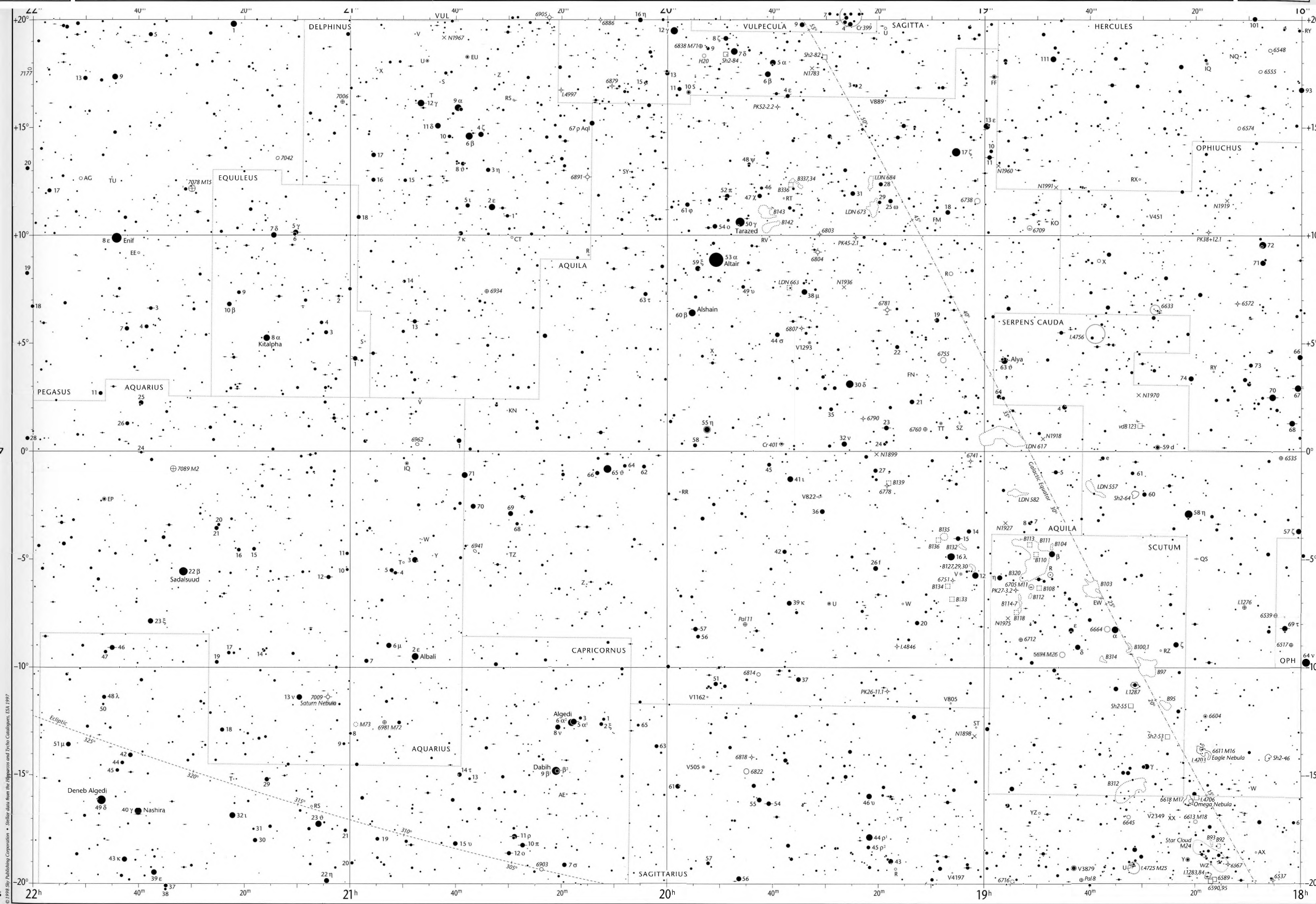
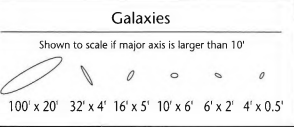
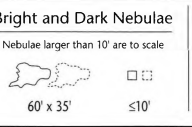
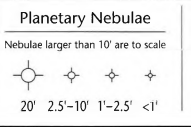
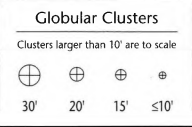
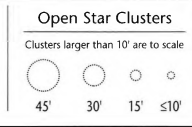
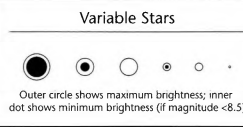
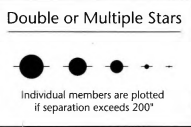
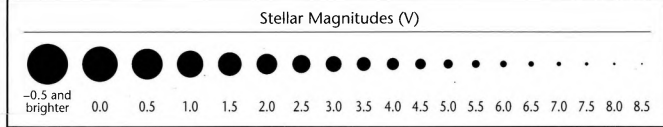
Nebulae larger than 10' are to scale

Galaxies

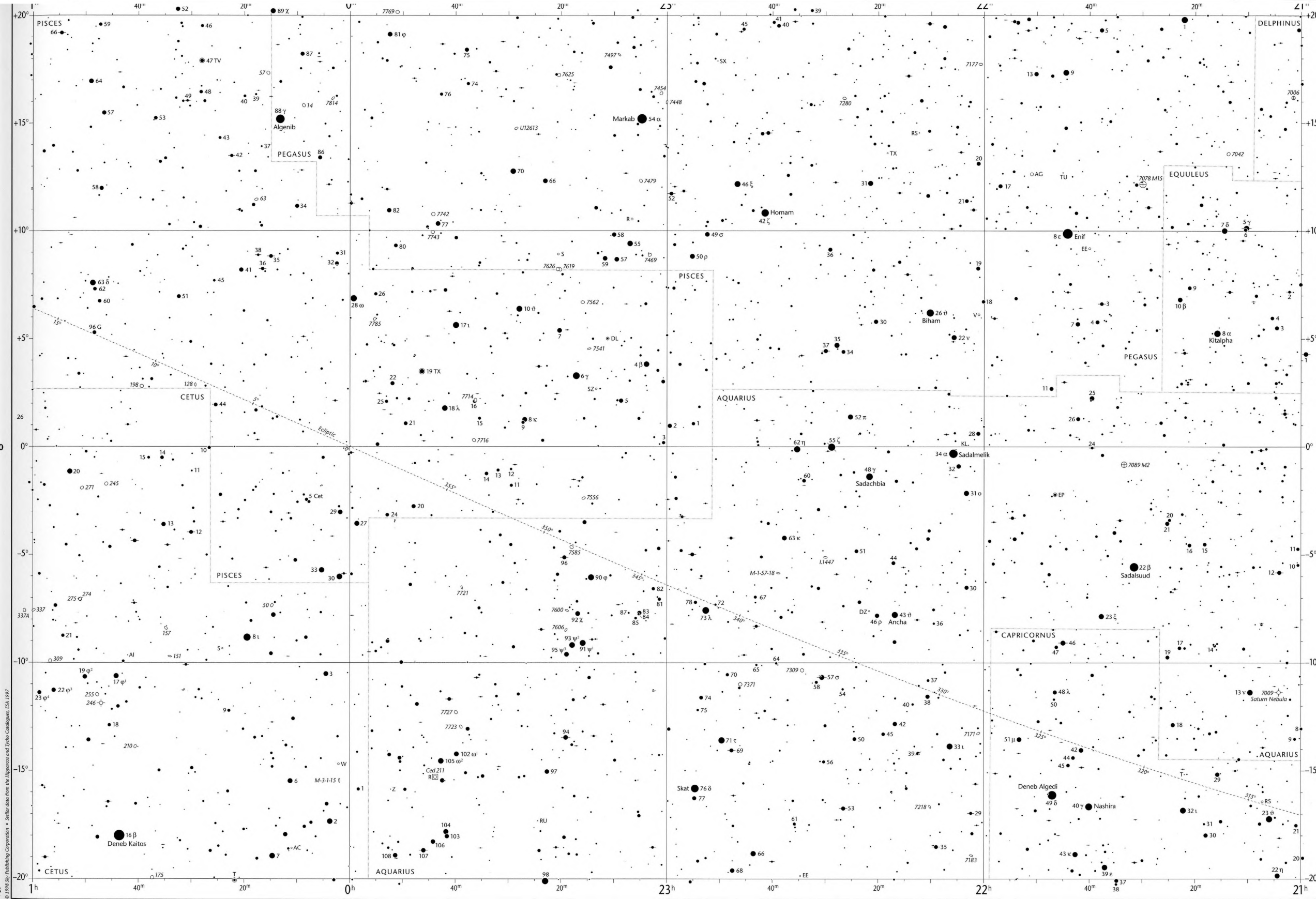
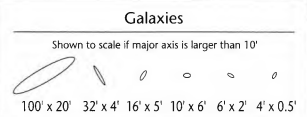
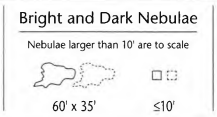
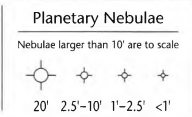
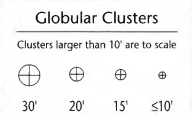
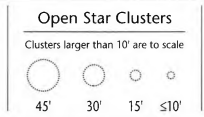
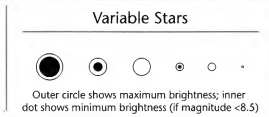
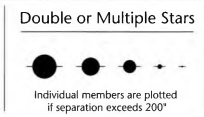
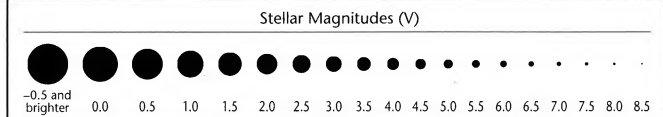
Shown to scale if major axis is larger than 10'

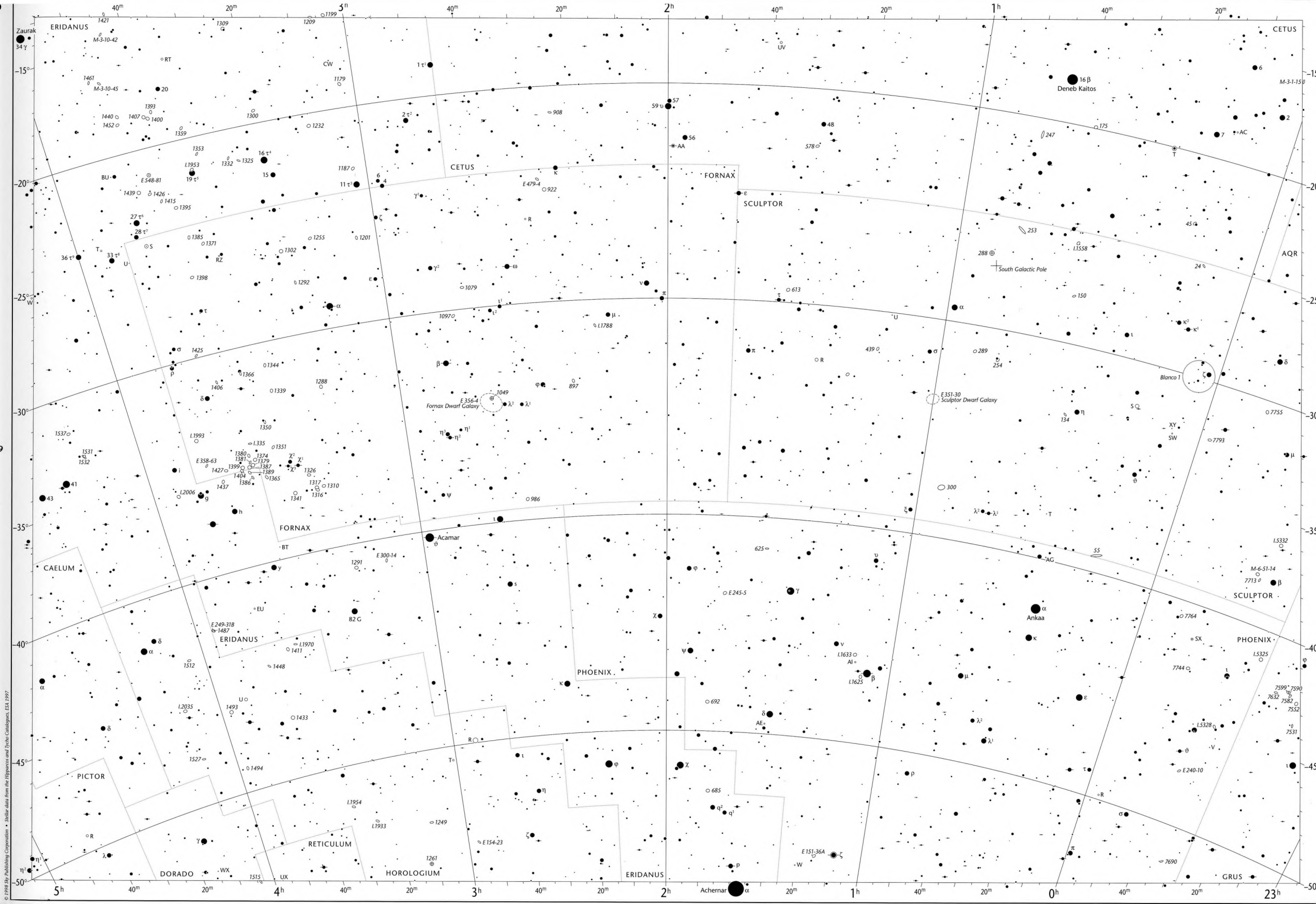
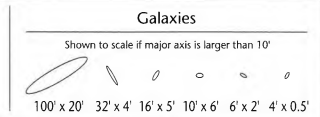
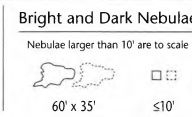
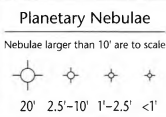
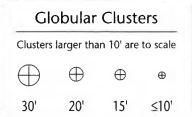
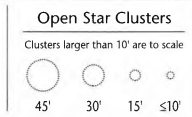
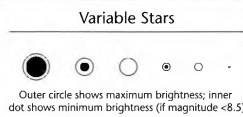
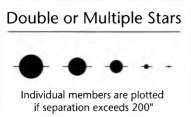
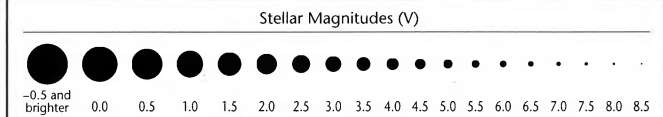
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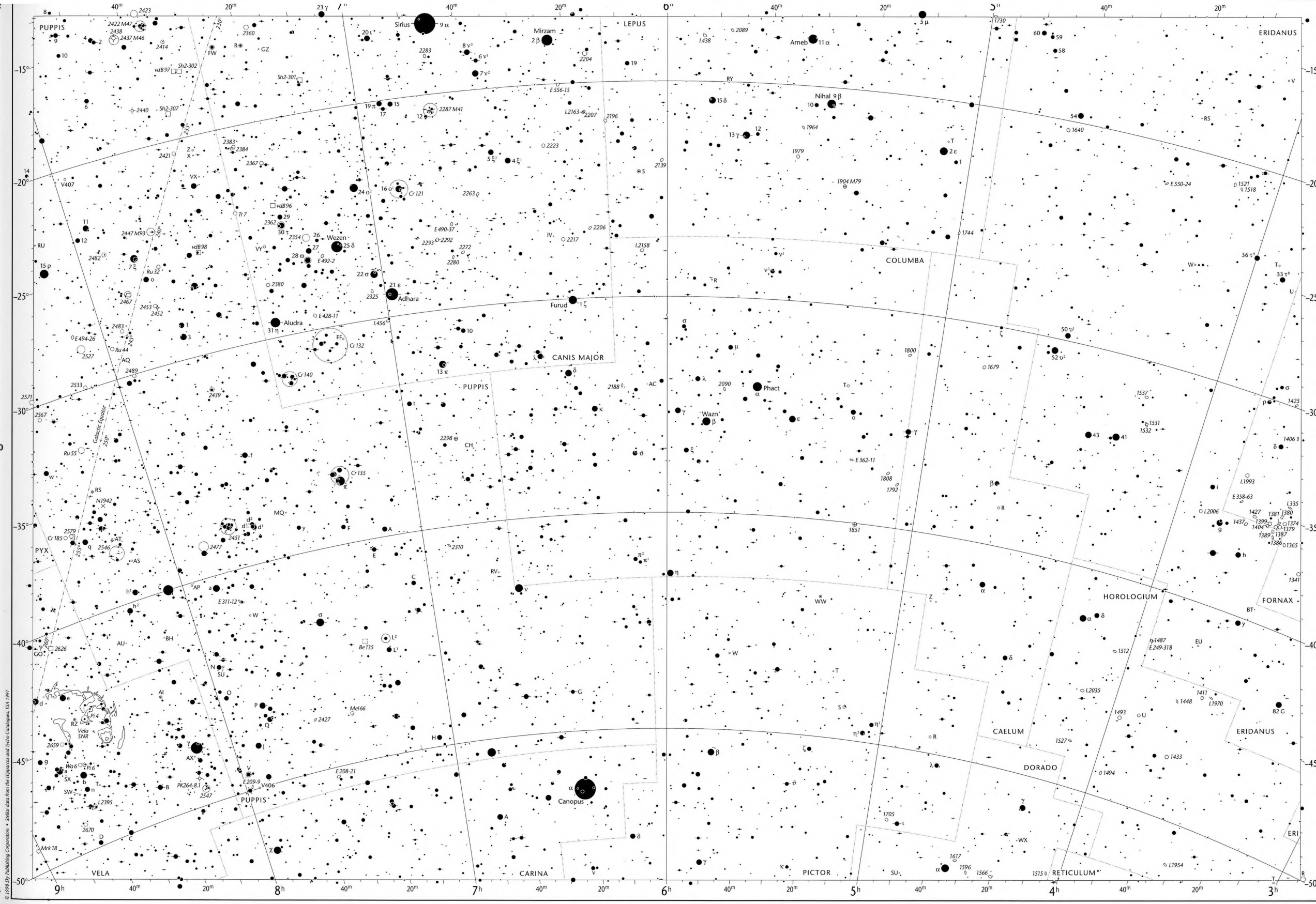
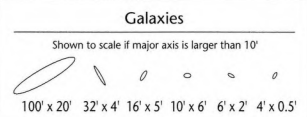
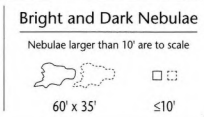
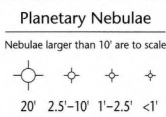
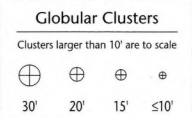
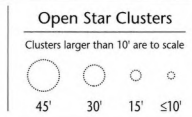
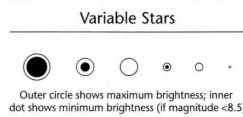
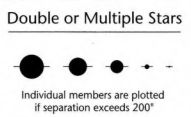
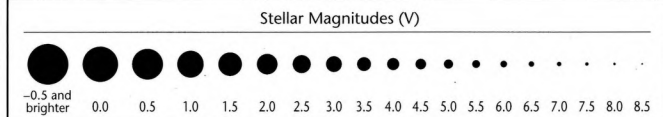














Stellar Magnitudes (V)

Individual members are plotted if separation exceeds 200"

Double or Multiple Stars

Outer circle shows maximum brightness; inner dot shows minimum brightness (if magnitude < 8.5)

Variable Stars

Clusters larger than 10' are to scale

Open Star Clusters

Clusters larger than 10' are to scale

Globular Clusters

Nebulae larger than 10' are to scale

Planetary Nebulae

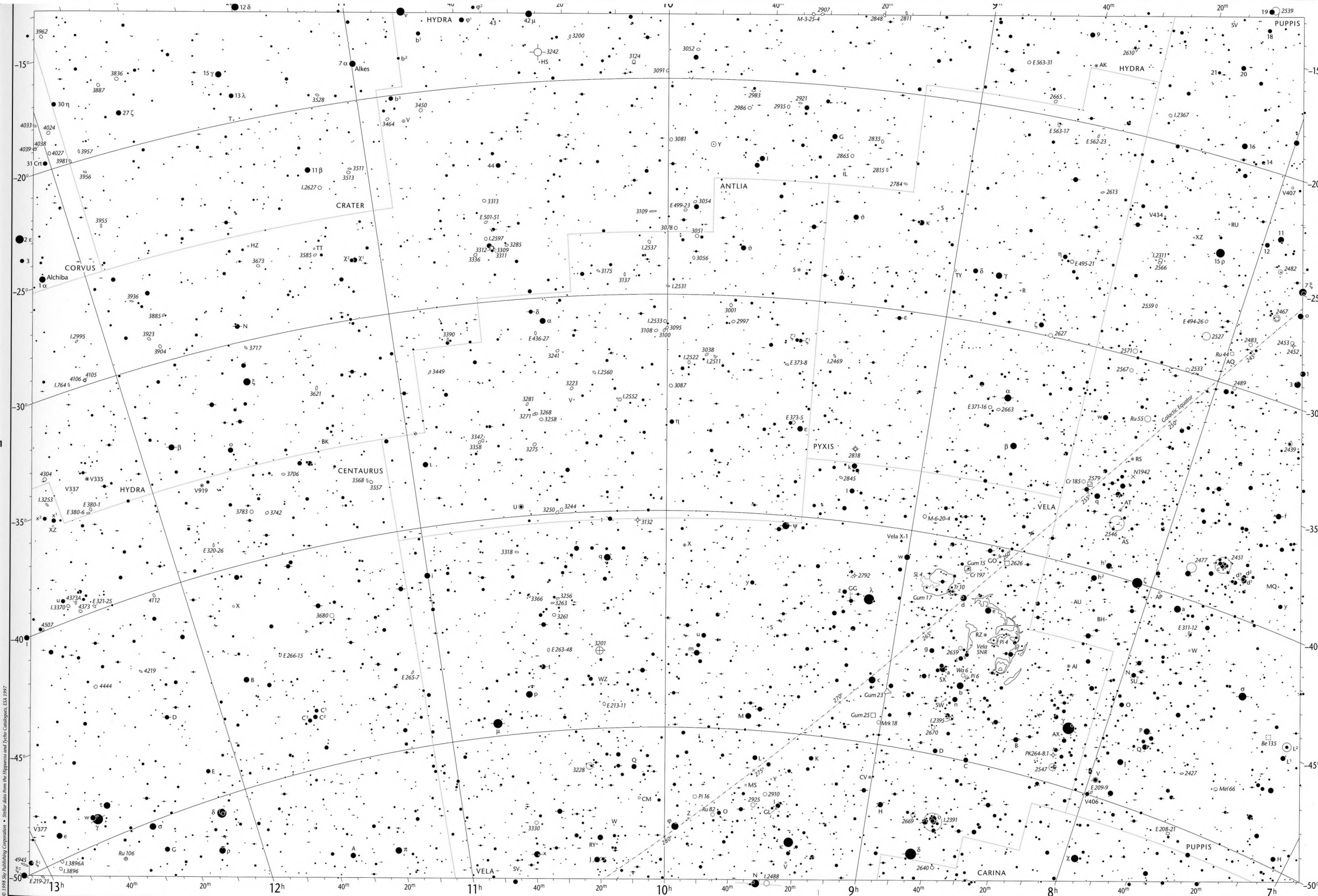
Nebulae larger than 10' are to scale

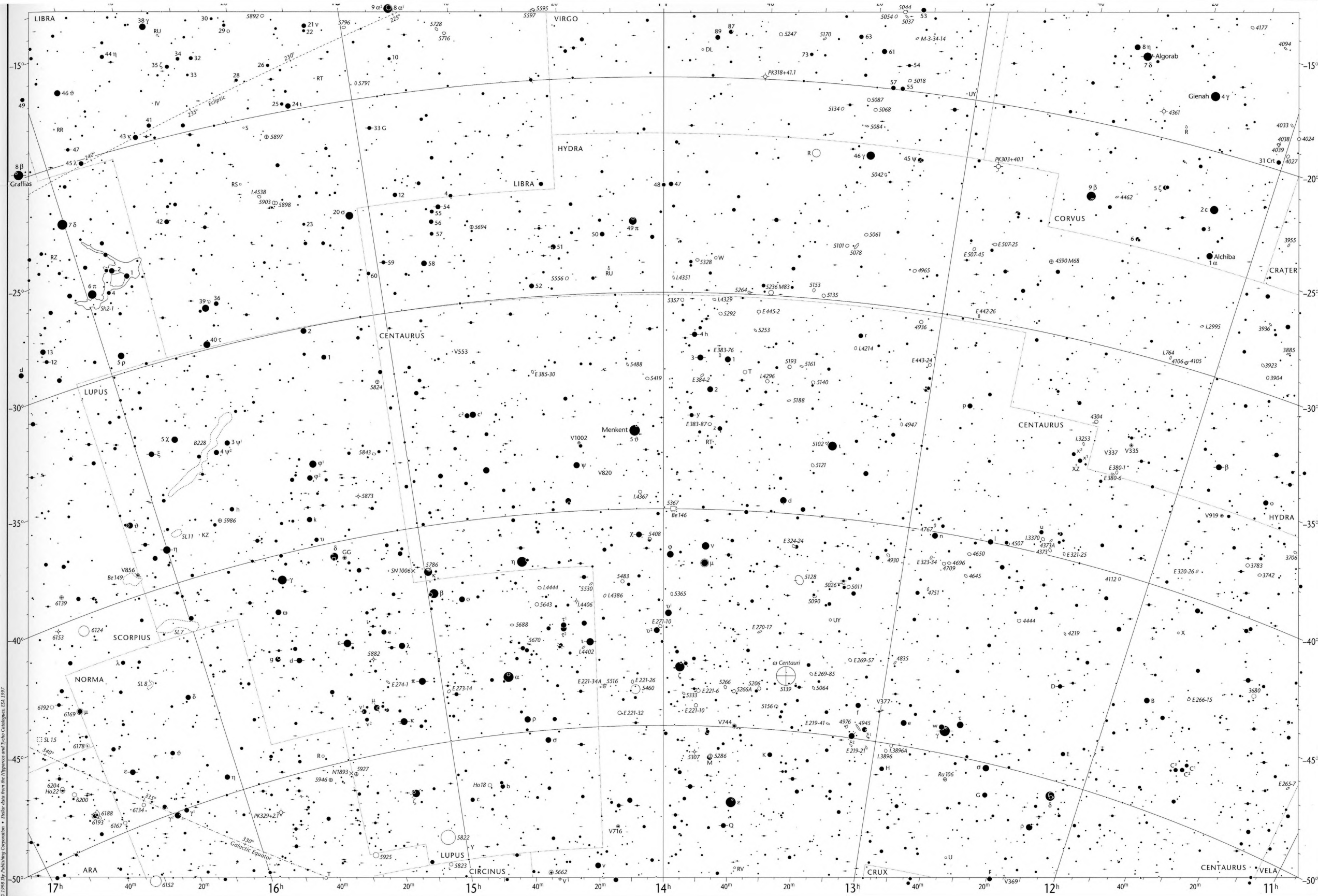
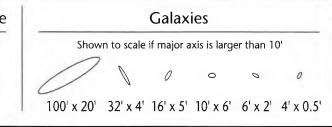
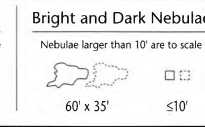
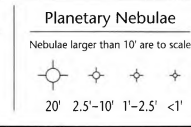
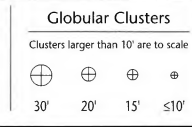
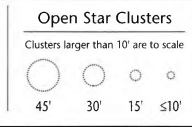
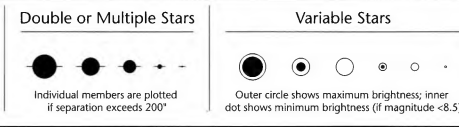
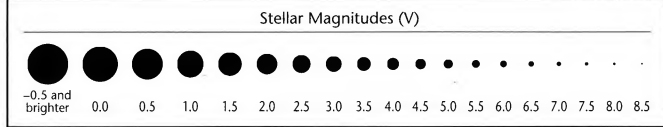
Bright and Dark Nebulae

Nebulae larger than 10' are to scale

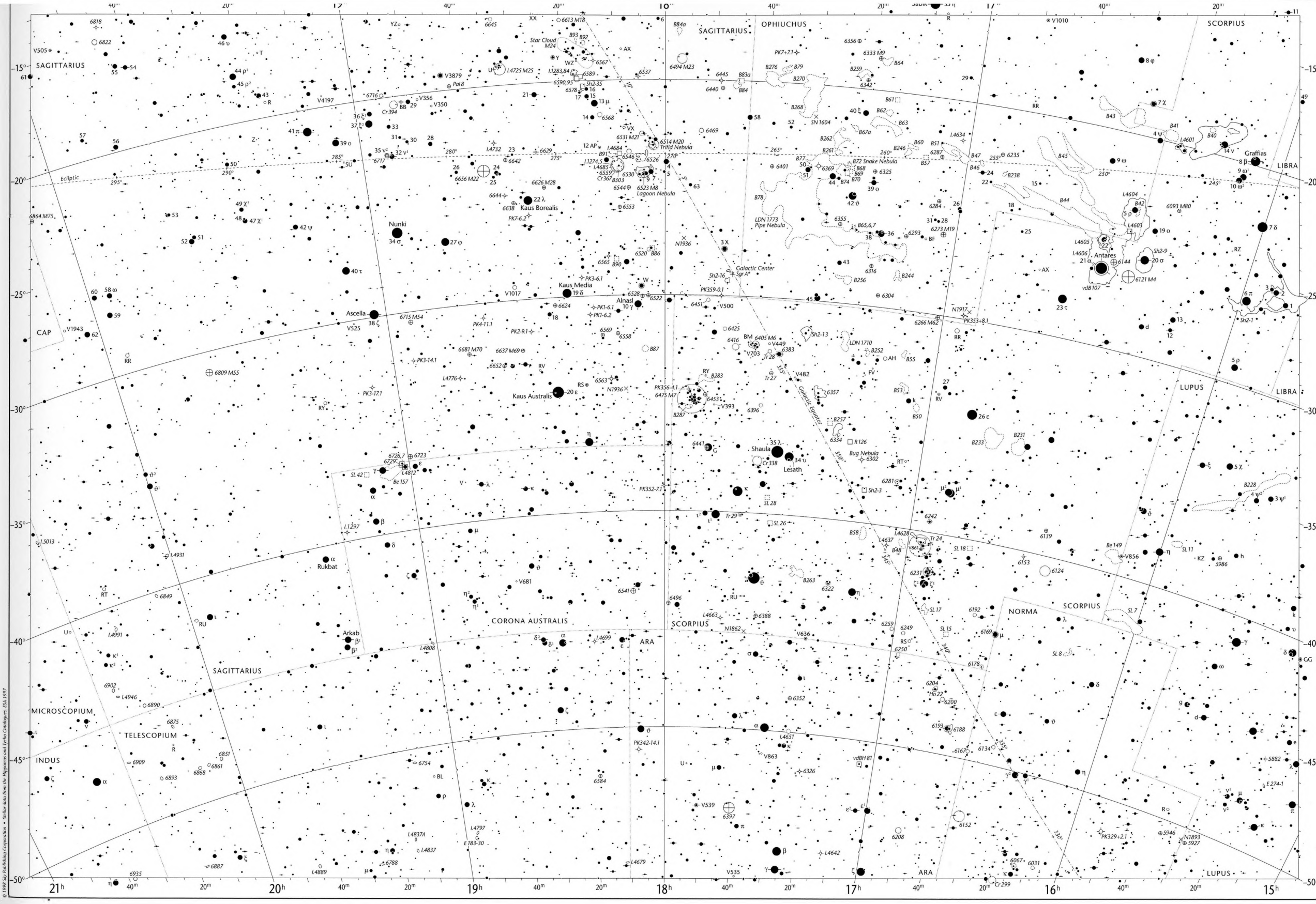
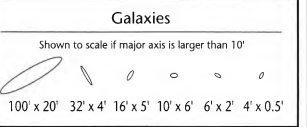
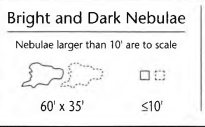
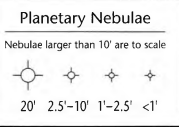
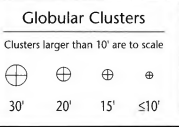
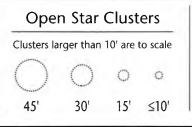
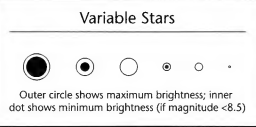
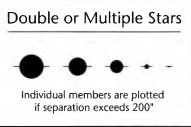
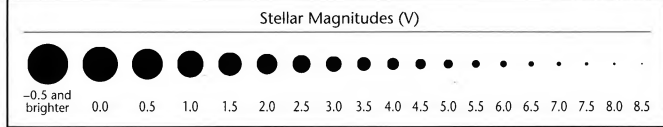
Galaxies

Shown to scale if major axis is larger than 10'



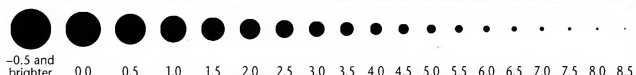




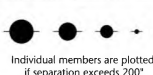




Stellar Magnitudes (V)



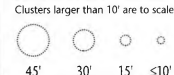
Double or Multiple Stars



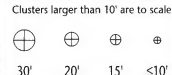
Variable Stars



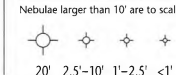
Open Star Clusters



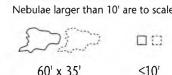
Globular Clusters



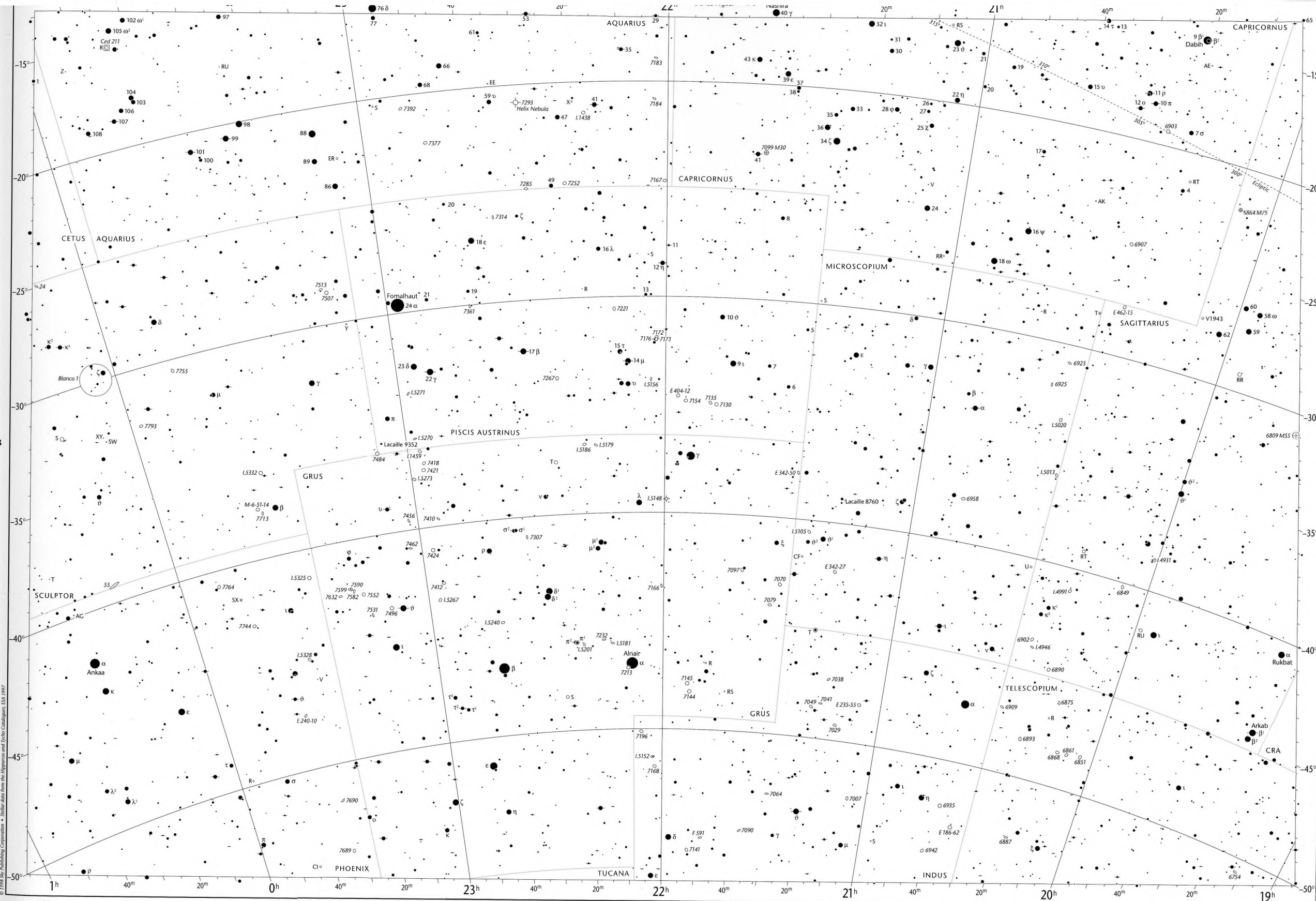
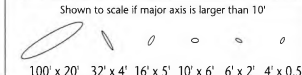
Planetary Nebulae



Bright and Dark Nebulae



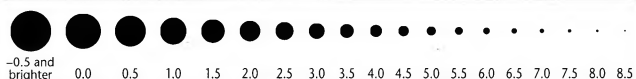
Galaxies



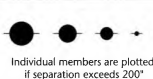




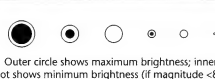
Stellar Magnitudes (V)



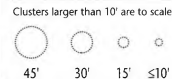
Double or Multiple Stars



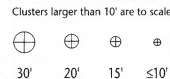
Variable Stars



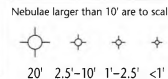
Open Star Clusters



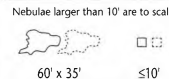
Globular Clusters



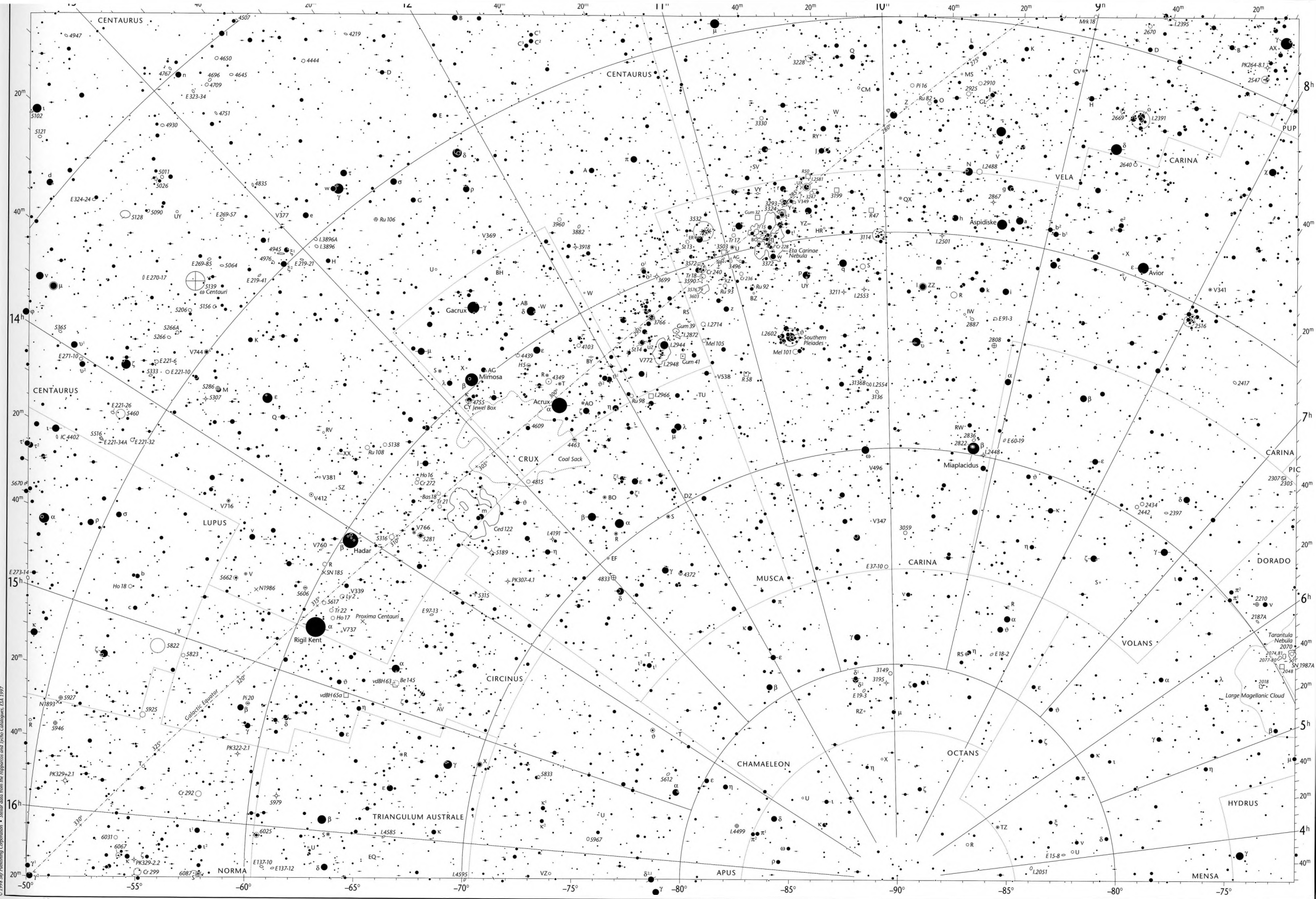
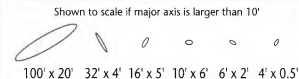
Planetary Nebulae



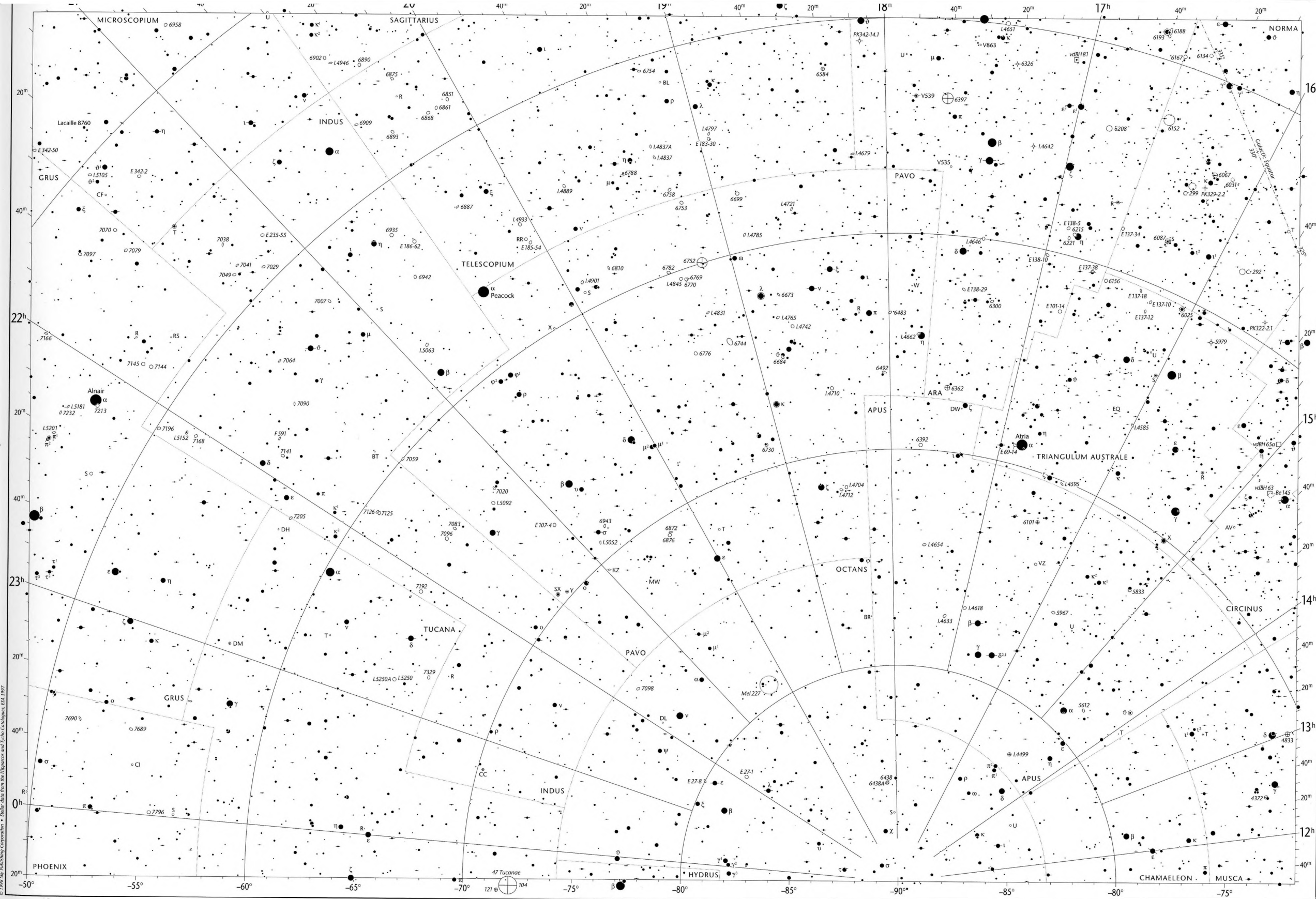
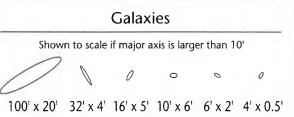
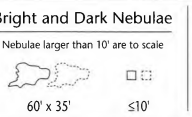
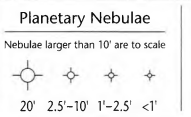
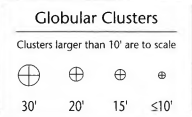
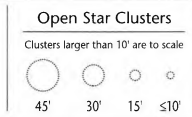
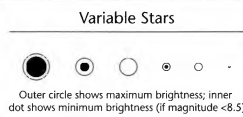
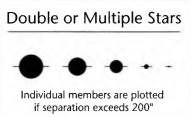
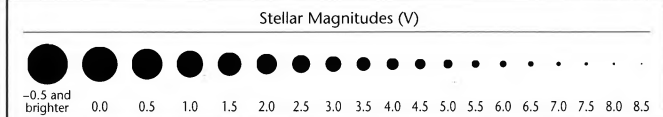
Bright and Dark Nebulae



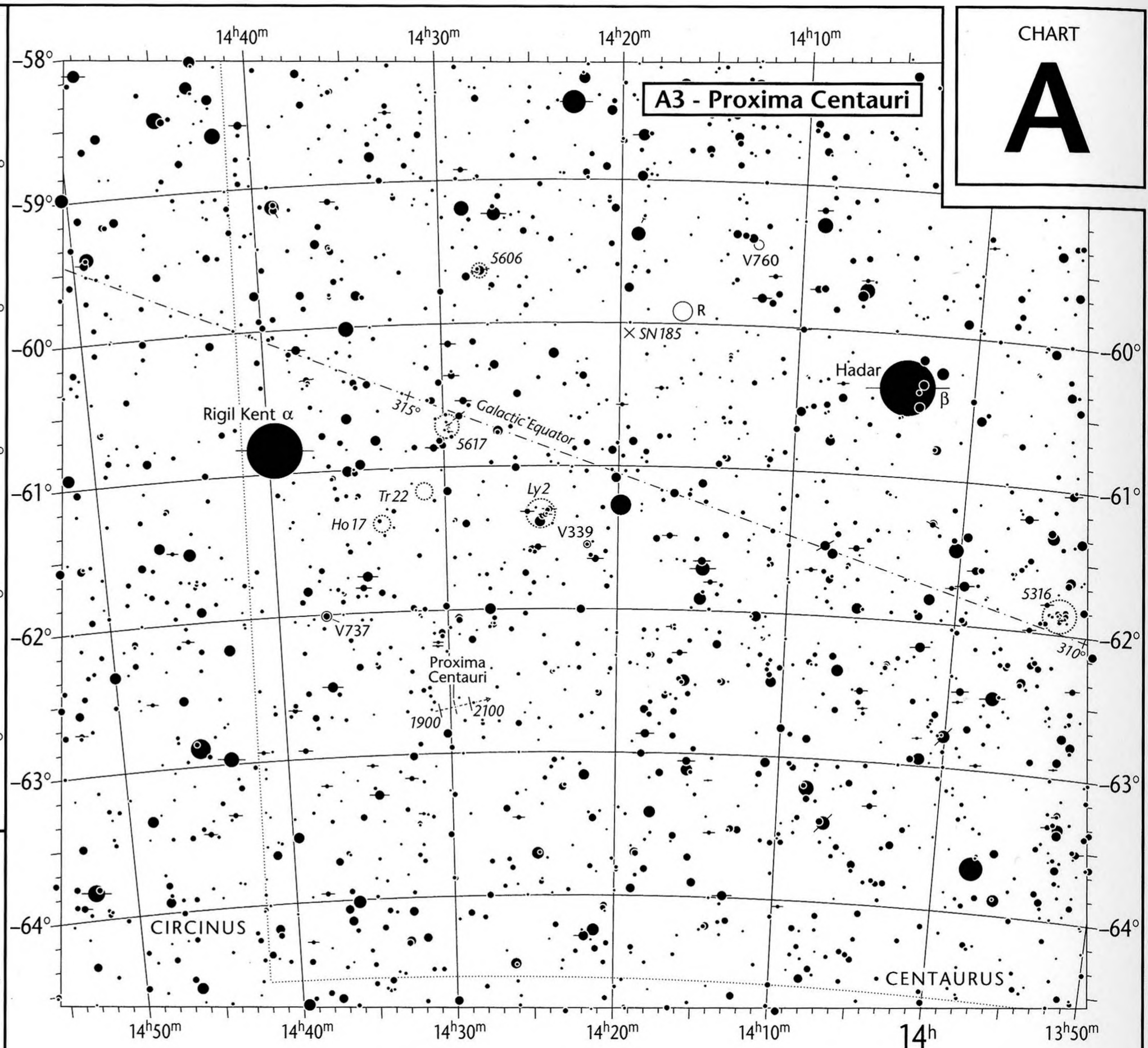
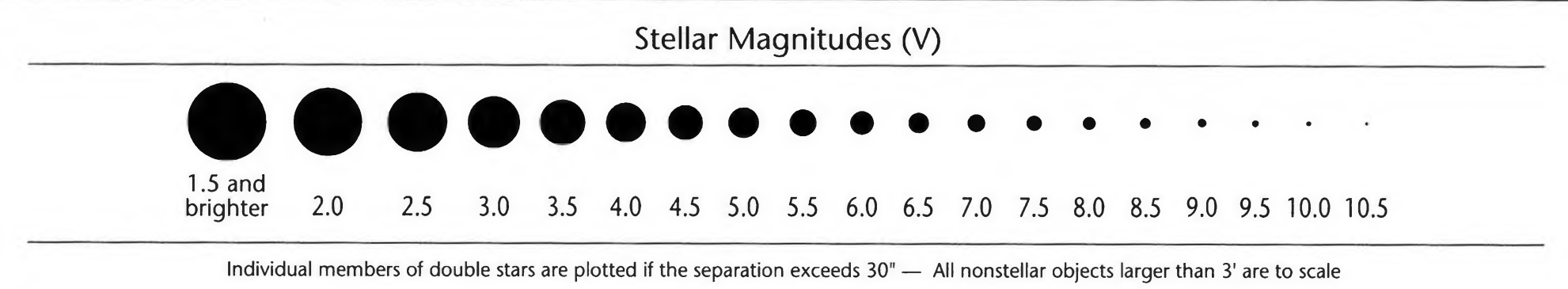
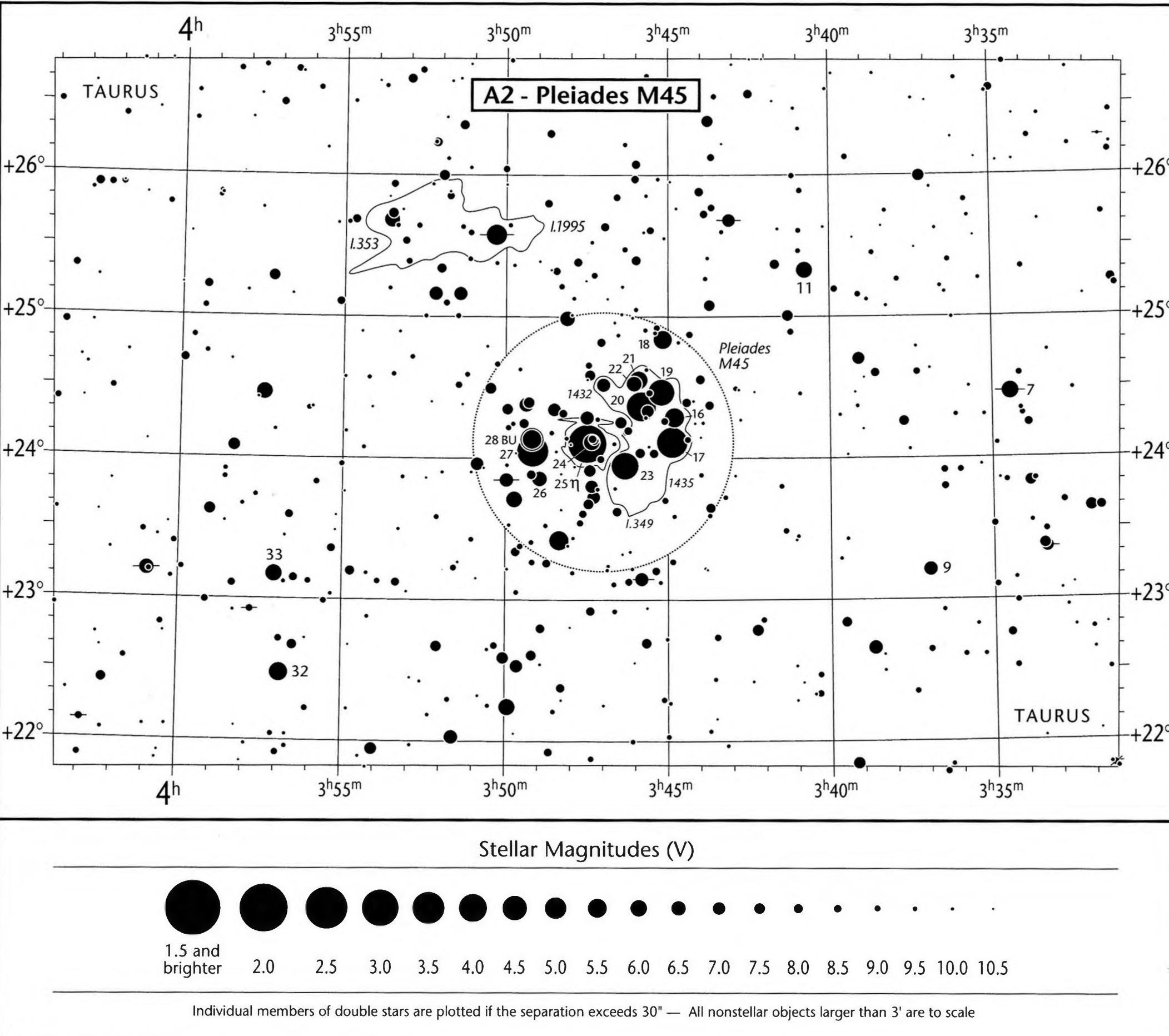
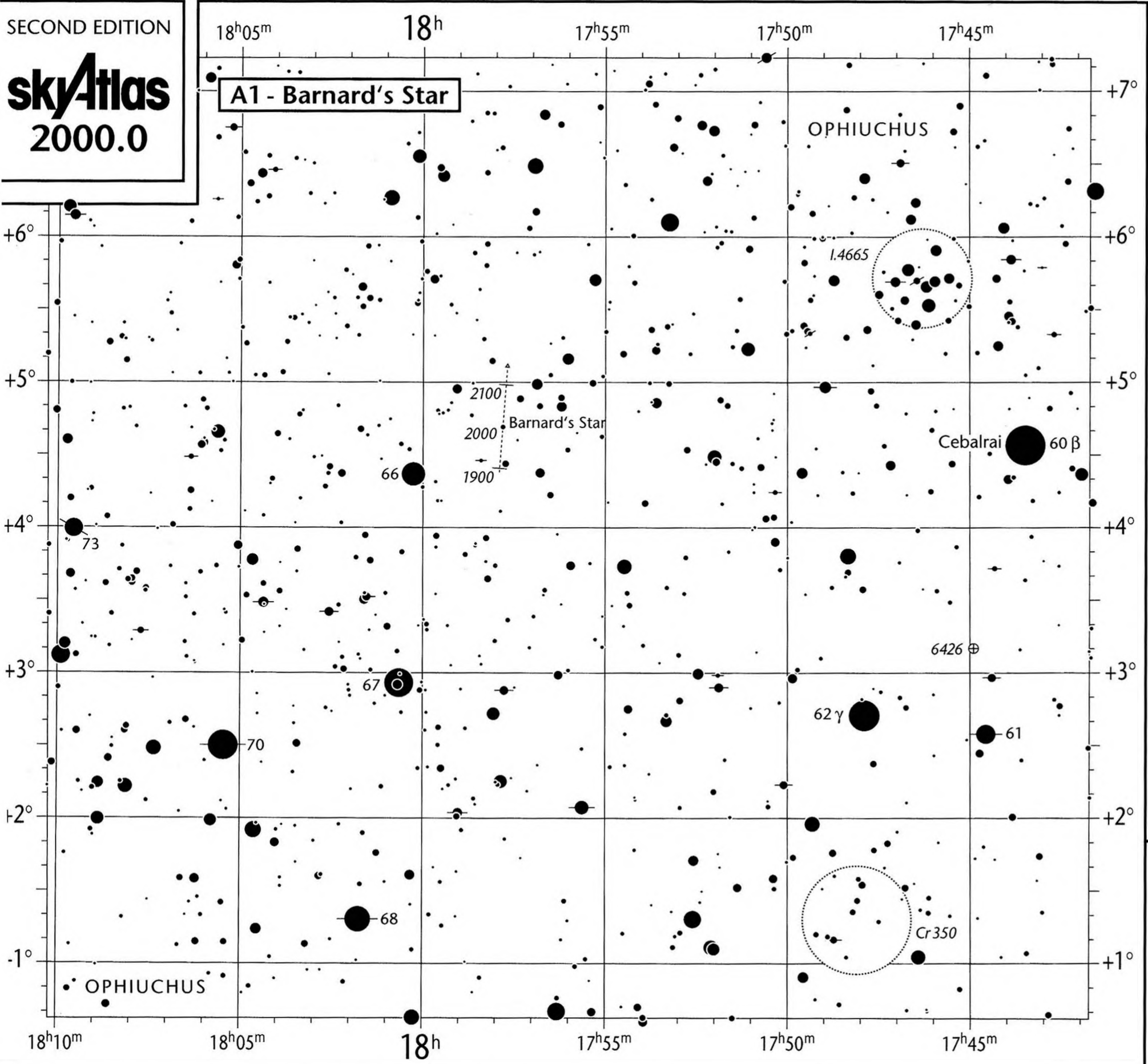
Galaxies









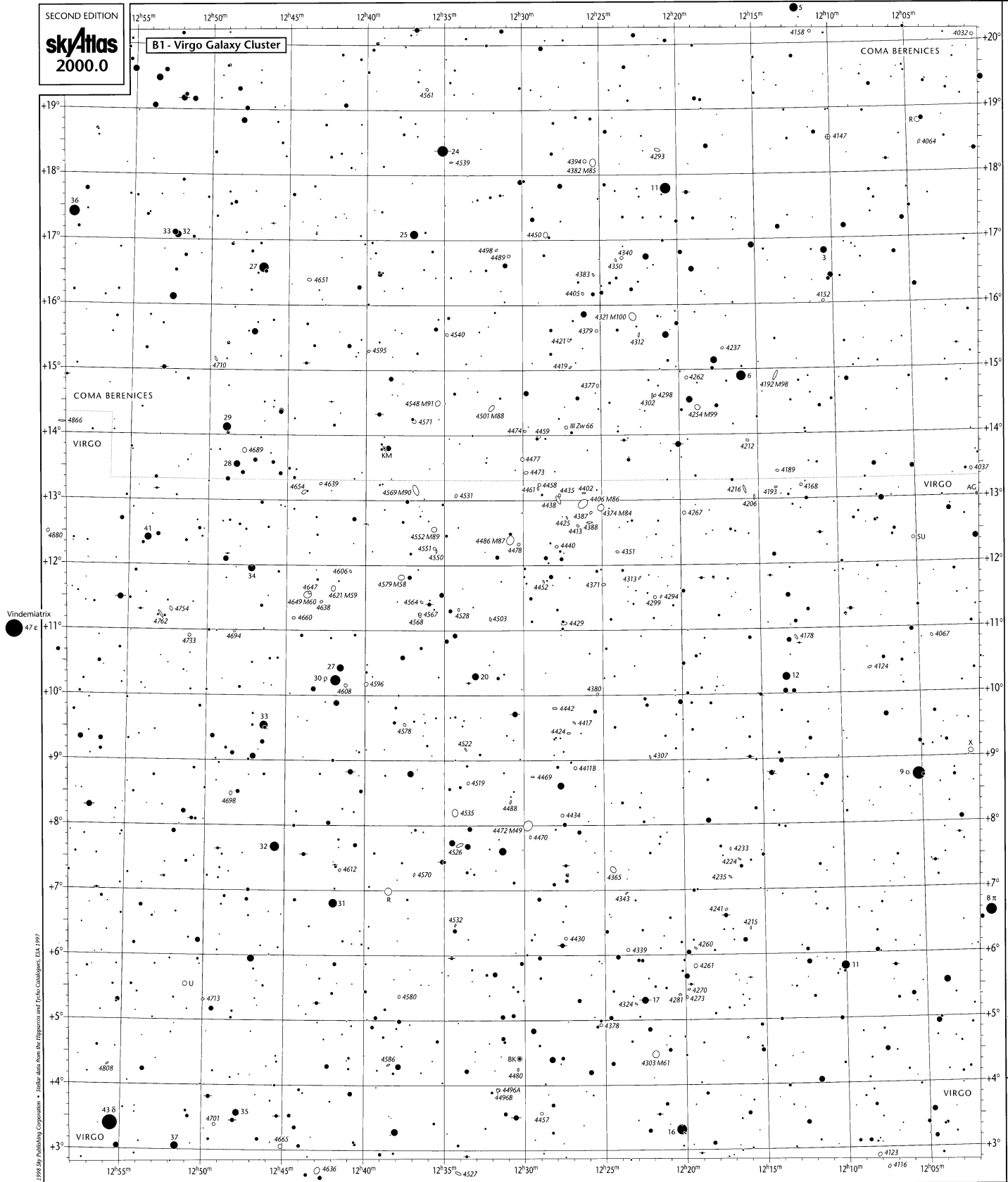




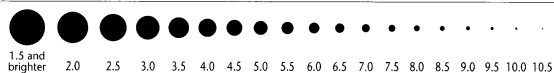




## B1 - Virgo Galaxy Cluster



## Stellar Magnitudes (V)



Individual members of double stars are plotted if the separation exceeds 30" — All nonstellar objects larger than 3' are to scale

